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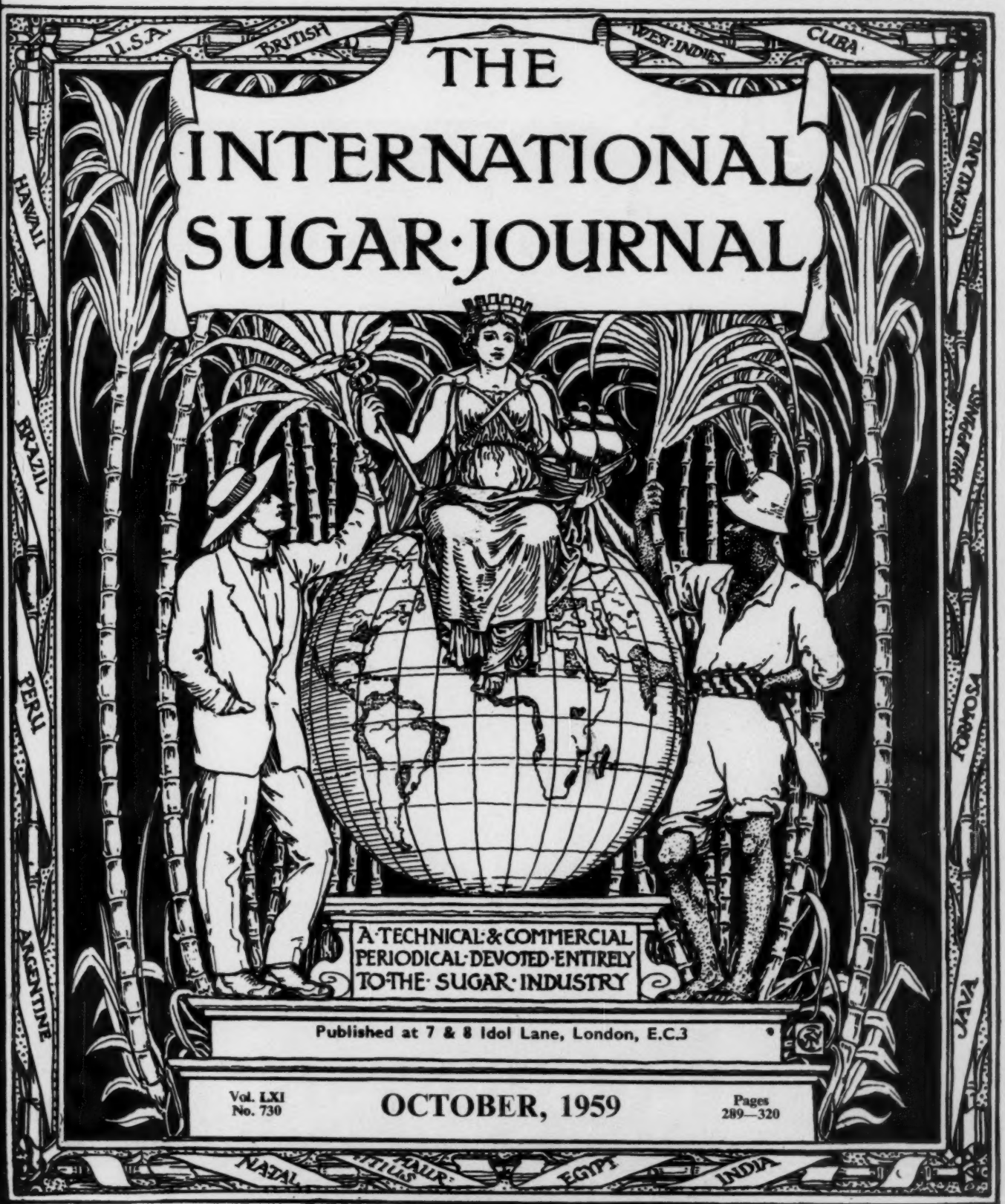

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A·TECHNICAL·&·COMMERCIAL PERIODICAL·DEVOTED·ENTIRELY TO·THE·SUGAR·INDUSTRY

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No. 730

OCTOBER, 1959

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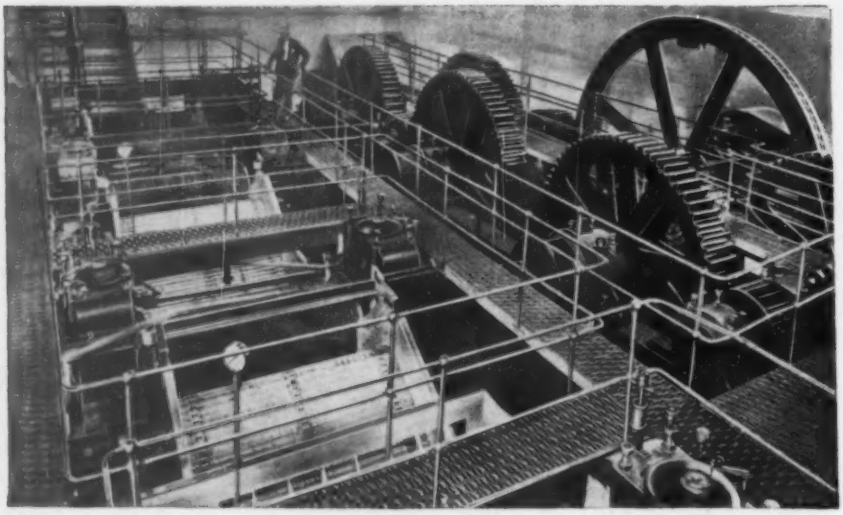

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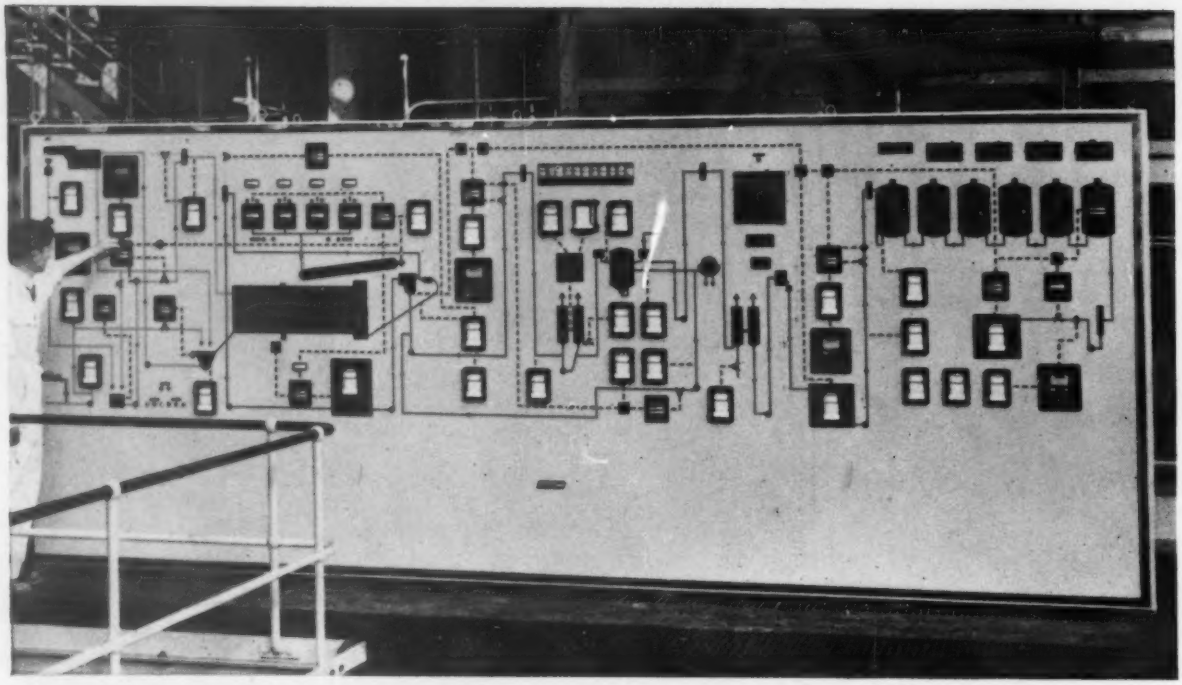

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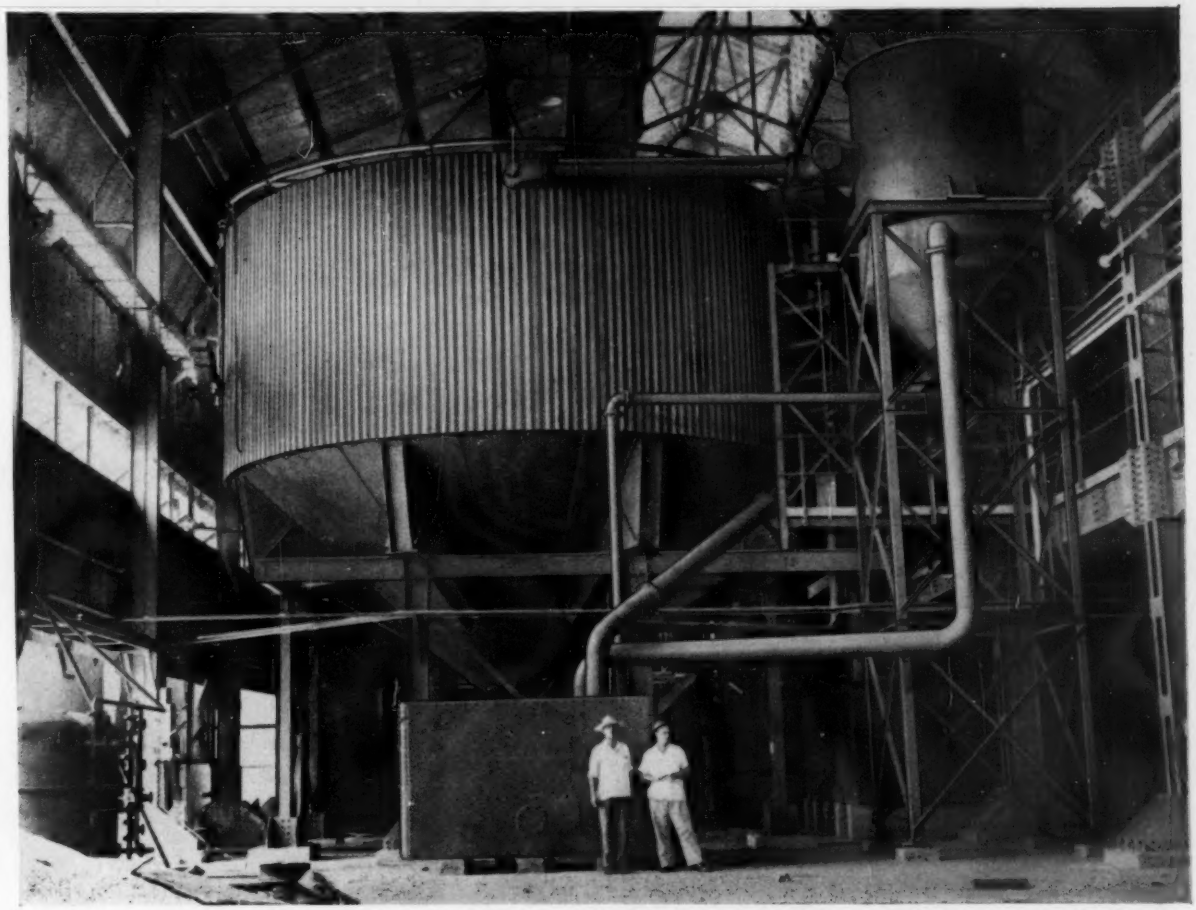

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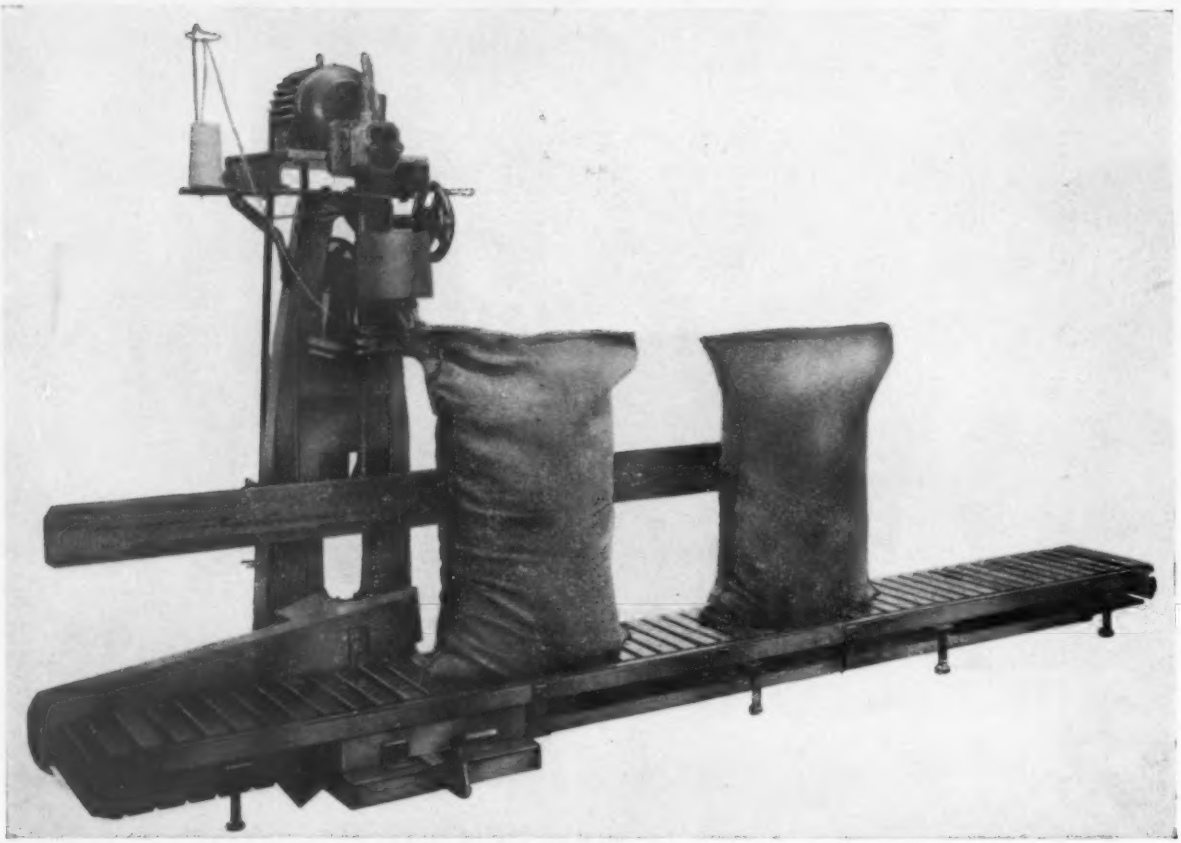

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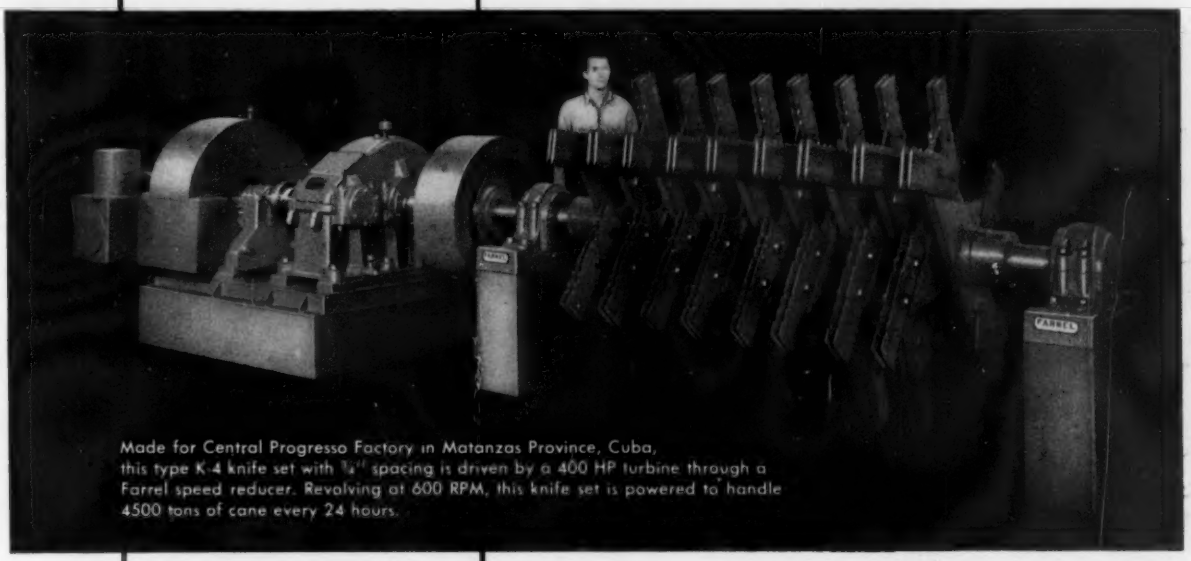

Made for Central Progresso Factory in Matanzas Province, Cuba, this type K-4 knife set with 3/4" spacing is driven by a 400 HP turbine through a Farrel speed reducer. Revolving at 600 RPM, this knife set is powered to handle 4500 tons of cane every 24 hours.

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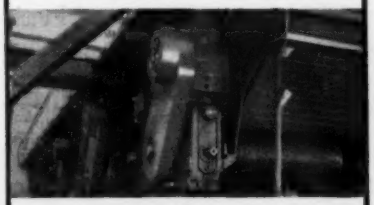

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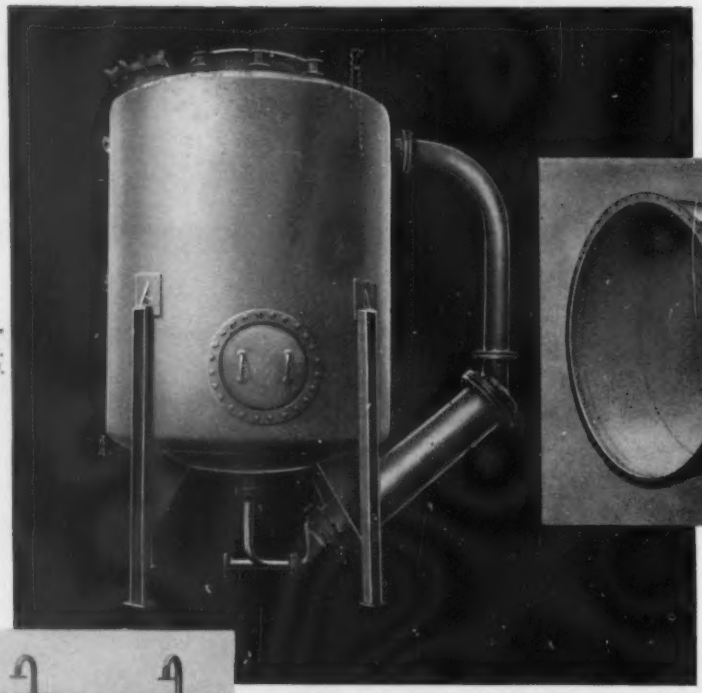
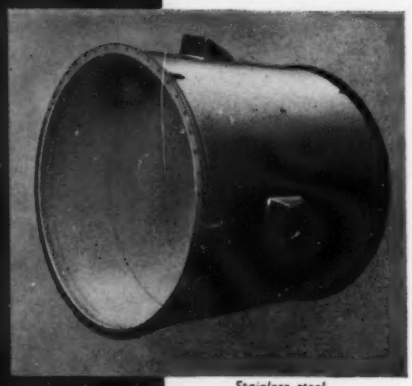


1,000 gall. kettle in ¼" copper. Lynx Quasi-arc welded.



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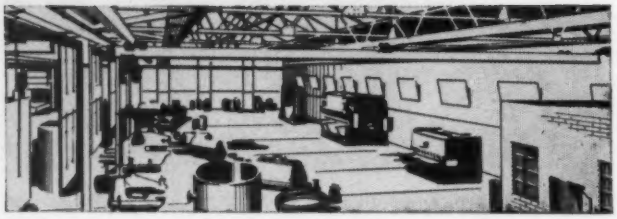

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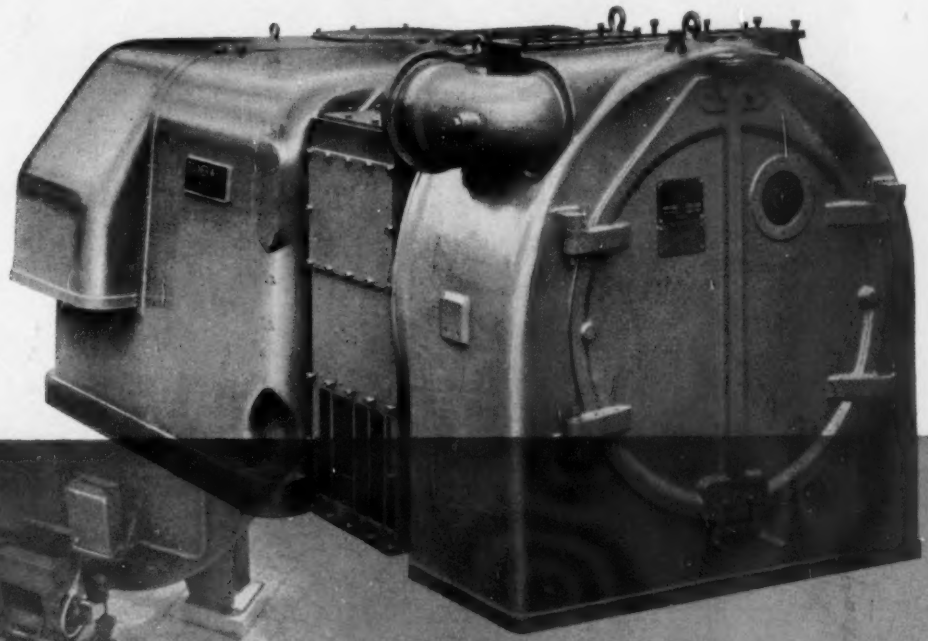
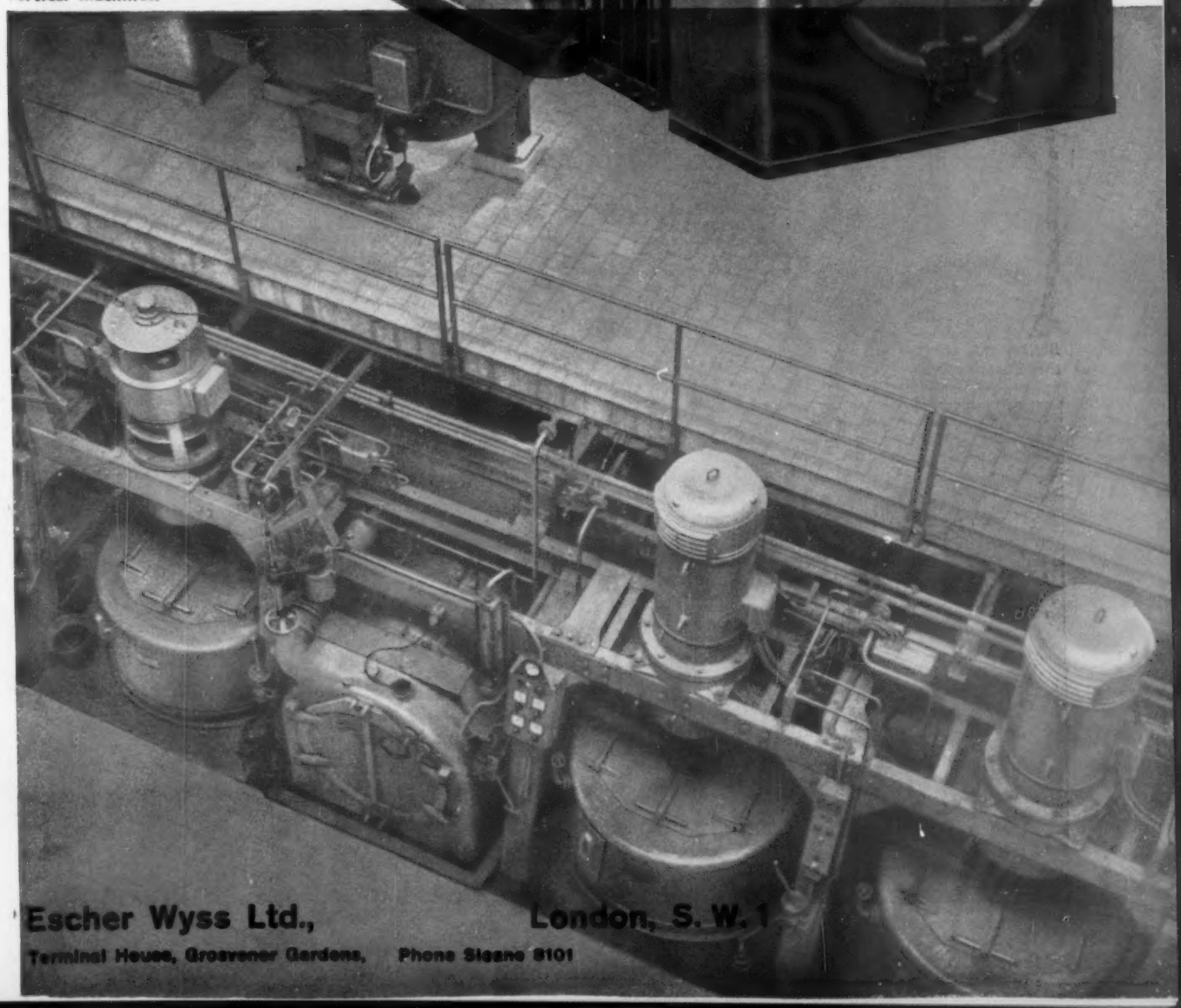


Escher Wyss Centrifuge as replacement in a battery of vertical machines.



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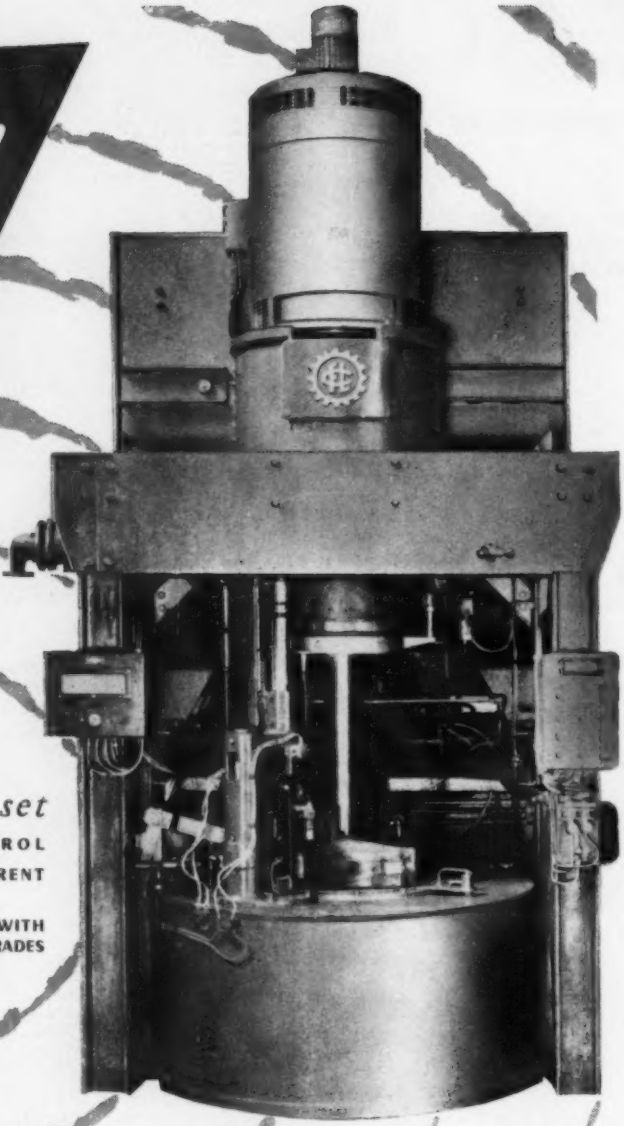

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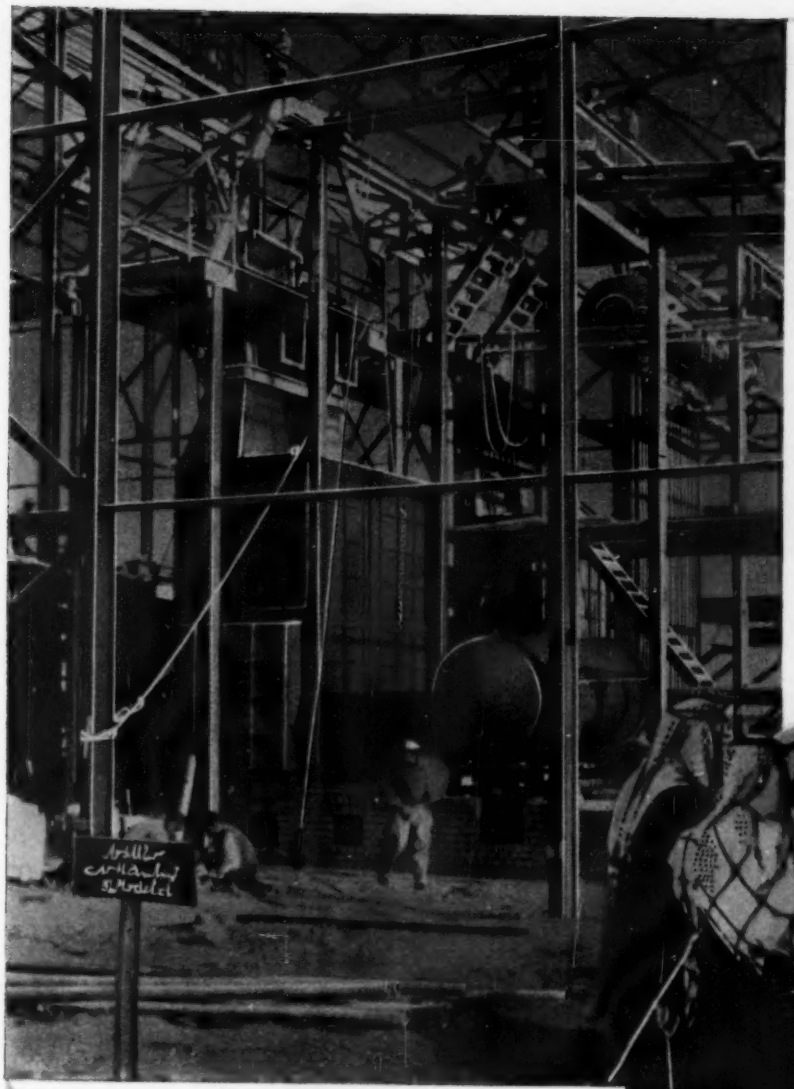

A little chat about factory routine among Arab foremen, whilst the erection of the Salzgitter sugar factory forges ahead on the sunny banks of the lazy River Tigris

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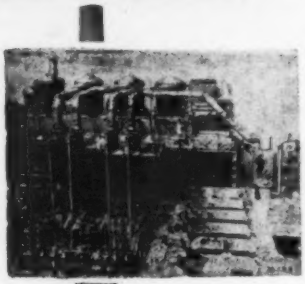

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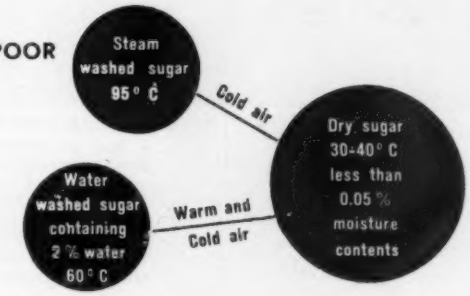
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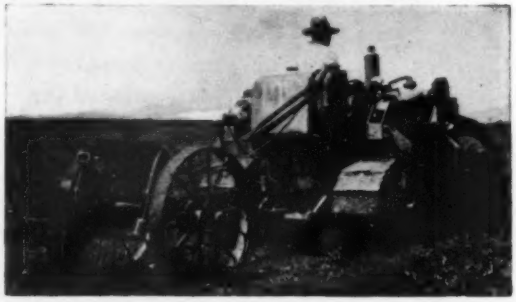

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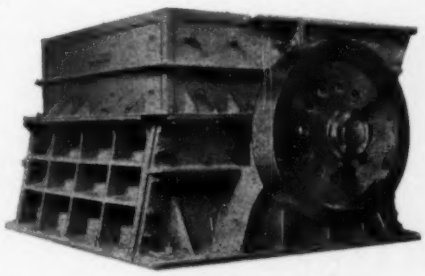

The Gruendler Cane Preparation Process has stepped up mill tonnages of cane per day by 15% to 25%, while delivering an evenly processed cane from which sucrose extraction has been increased from 3% to 4%. These percentages remain contant, no matter where the cane is grown. Using this increased tonnage, many mills have paid for the Gruendler Process in one crop.

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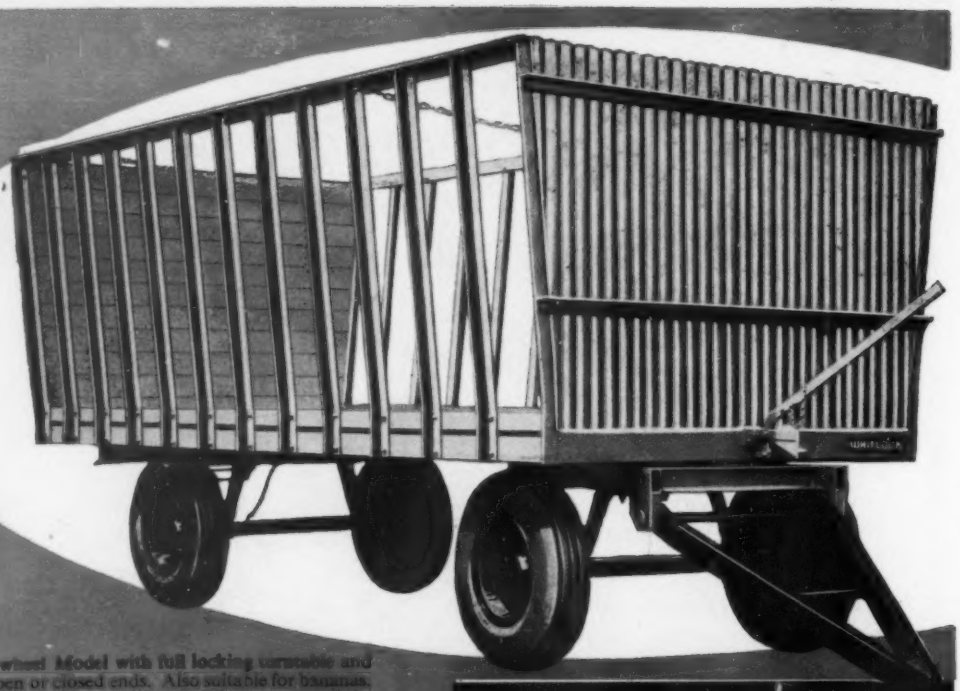

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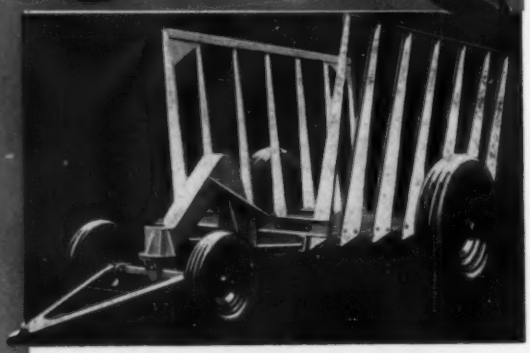
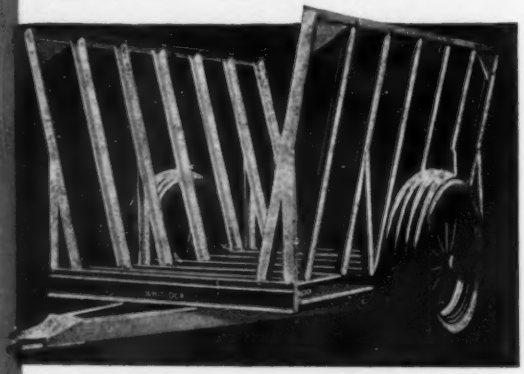


4-wheel Goose-Neck type of pressed steel construction with extra heavy bracing for loads up to 6 tons.



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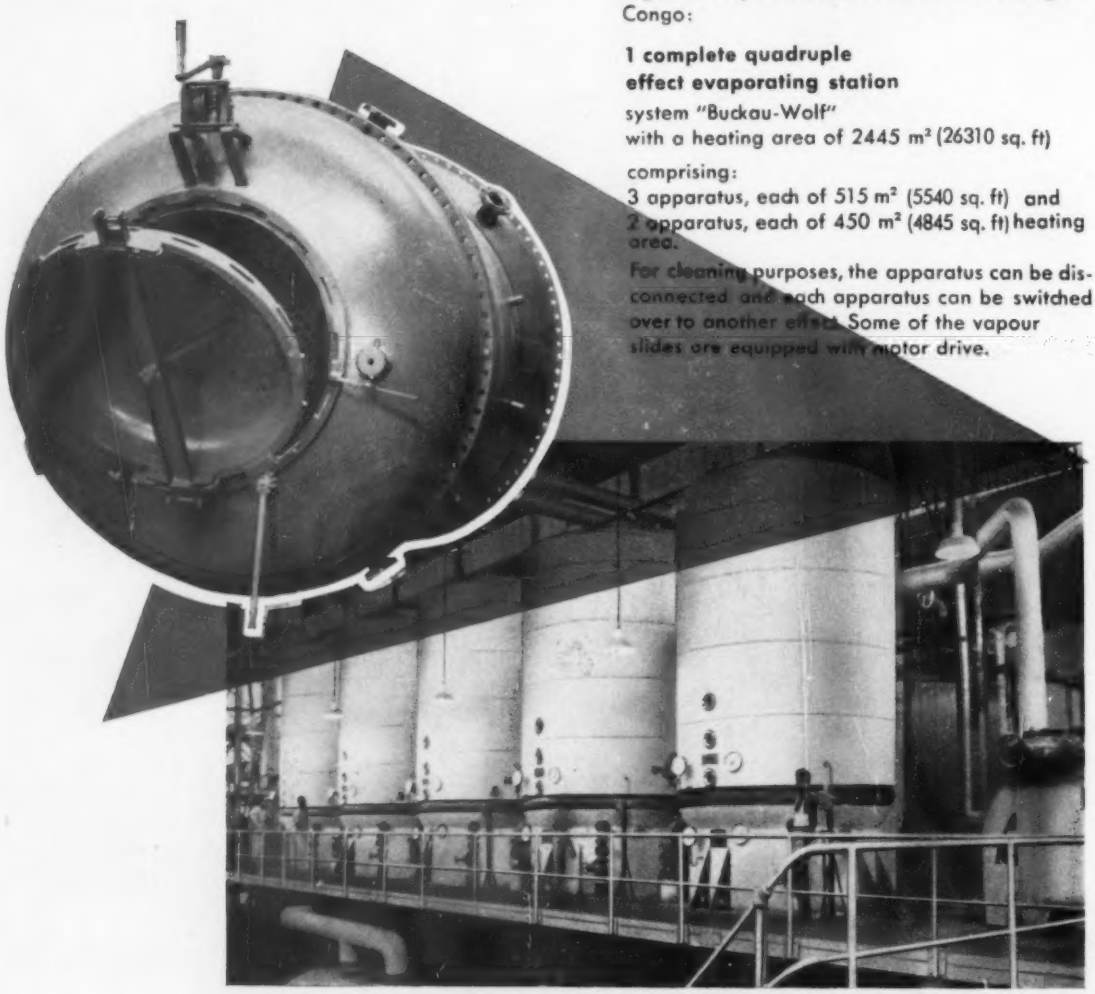

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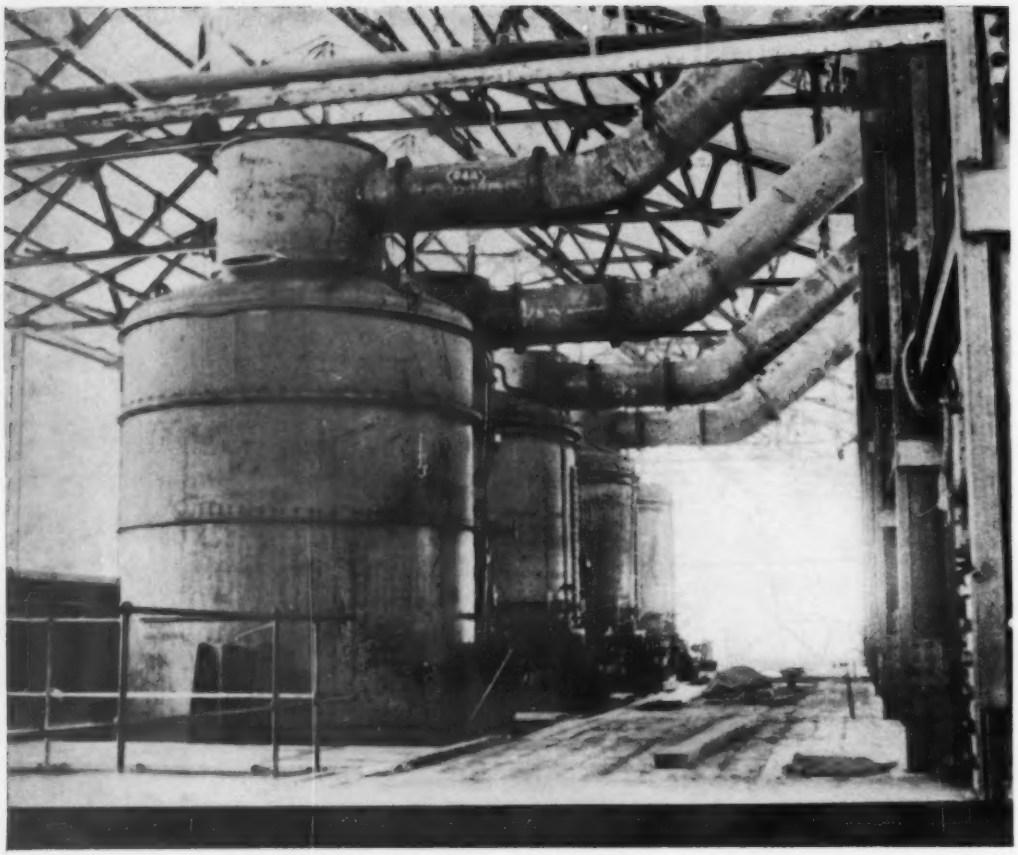

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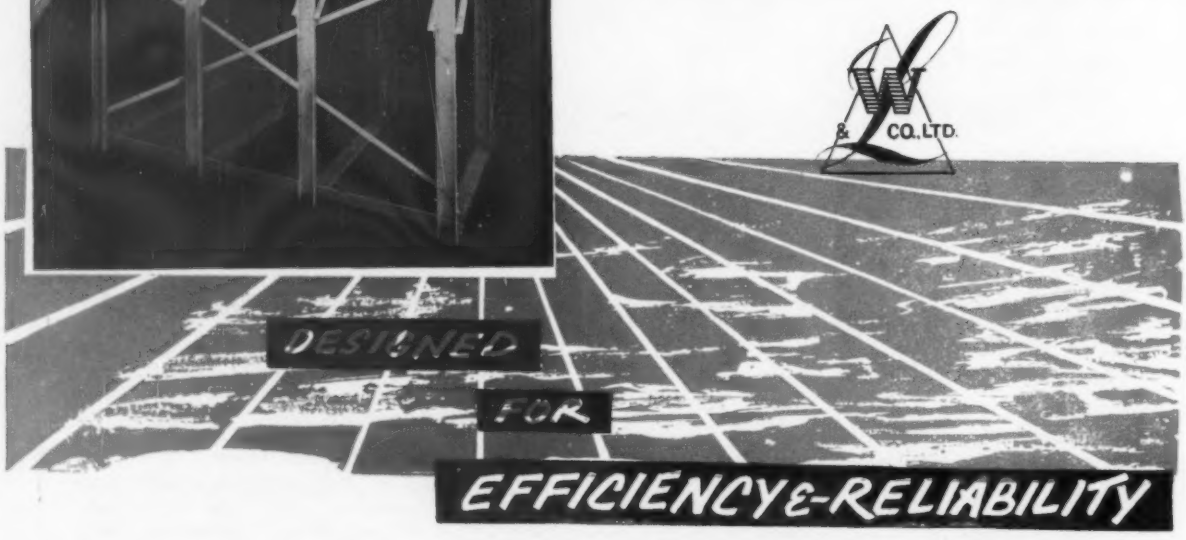

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THE
INTERNATIONAL SUGAR JOURNAL

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NOTES AND COMMENTS

South African Sugar Association Annual Report 1959/60.

The year under review has been a record one in many respects. Great prominence has been given to the growth of the Industry and the setting up of new records in sugar and sugarcane production.

When the expansion programme was launched on 1st May, 1948, growers were given the protection of an 11 year period in which to increase their production and raise the level of their basic quotas. This period expired at the close of the past season with a production well in excess of the target of 1,000,000 tons that had been set.

In producing 1,128,187 tons of sugar the Industry has expanded to the stage where thought has to be given to relating production to all available markets. A total of 10,256,776 tons of cane was crushed to attain this record production, resulting in a cane/sugar ratio of 9·09, the highest conversion ratio recorded since the second World War. It is therefore not surprising that with this vast tonnage of cane passing through the mills, milling efficiency suffered somewhat.

A small mill at Big Bend in Swaziland commenced operations in August, 1958, and as the mill decided to continue production to 30th April, 1959, it became necessary to assess the estimated production for the season, in order to be in a position to declare the final average price and quota determinations for the Union Industry when the last mill closed in the middle of March. The production was assessed at 7,236 tons, which increased the overall production from which the markets of the Industry could be supplied to 1,135,423 tons.

During the year refineries installed at the Gledhow and Umfolozi mills came into operation, the latter however only on a trial basis towards the end of the season, with a production of 1,771 tons of refined sugar. Umfolozi previously produced its quota of white sugar in the raw state in terms of an arrangement with Hulett's South African Refineries, Ltd. Refineries are now established at five mills along the coastal belt, in addition to the central refinery at Rossburgh, and in future the bulk of the white sugar produced by the Industry will be in refined form.

Crushing operations at the mills were again seriously hampered by the inability of the Railway Administration to supply an adequate service on the North Coast line. Breakdowns in train schedules through various factors were all too frequent and resulted in continual mill and field stoppages. The Industry is grateful to the Railway Administration for achieving quite remarkable results in moving a record cane and sugar crop in the most difficult circumstances. Railway developments on the North Coast are making favourable progress and within a few years it is hoped that the difficulties experienced will become nothing more than unpleasant memories. The crushing season had to be extended well into February to cope with the vast cane crop that was available, and it is estimated that over 500,000 tons of mature cane remained unharvested.

During 1958 the Industry exported its greatest volume of sugar since the commencement of the Commonwealth Sugar Agreement in 1950. All quotas under the Commonwealth and International Sugar Agreements were completely fulfilled, and in addition, full advantage was taken of the allocations received from deficiencies reported by other territories. The total quantity exported during the year to countries which included the United Kingdom, Rhodesia, Nyasaland, East Africa, Malaya and Korea was 247,228 long tons. In addition a surplus of 100,462 long tons was carried forward at the end of December for supply against Rhodesian requirements and 1960 overseas quotas.

After protracted discussions, the terms of the proposed agreement to be entered into between the Sugar Association and Swaziland millers for the regulation of the production and marketing of the 80,000 tons of sugar to be produced annually in Swaziland have been accepted by both parties.

At present only the small Ubombo Ranches mill at Big Bend is in production and the bulk of the sugar produced is going direct by rail to Rhodesia. A bigger mill capable of producing the 40,000 tons allocated by the Swaziland Government to the Company is in process of being erected.

The second mill owned by the Mhlume (Swaziland) Sugar Milling Co. Ltd., with the same production,

[1] *S. African Sugar J.*, 1959, **43**, 681-697.

quota, is at present under erection at Mananga, and will probably be in production early next year. There is therefore the distinct likelihood that in the 1960–61 season the full 80,000 tons will be available from Swaziland.

During the year the Association was advised through the Department that the Minister of Economic Affairs would be prepared to relieve Eshowe and Nkwaleni growers of their present obligations in regard to the supply of cane and approve the erection of a sugar mill at Nkwaleni on the understanding :

(*a*) that conclusive evidence was first submitted to show that the proposed mill would be an economic unit and for the planters concerned a better and more economic proposition than the present dispensation;

(*b*) that it be shown that the necessary funds to finance the establishment of the complete proposed milling plant could be raised.

The principle underlying the proposal is the detachment of growers from one mill and their attachment to another. This has caused grave concern among milling companies, who feel that if this precedent is established, they would have to accept the fact that any group of growers could combine in the establishment of a mill and the milling company or companies to which they are attached would have to accept the consequent loss of cane and a diminished return on the capital expended in building up milling facilities, after having helped such growers to establish themselves.

The growers on the other hand are not opposed to the erection of the mill, but stipulate that it is necessary to submit proof that the mill will become an economic proposition and will not have to rely upon concessions in one form or another that will become a burden upon the rest of the Industry either at present or in the future.

As members of the South African Sugar Association Technical Training Committee the Board assisted in carrying out investigations into the establishment of a course in sugar technology at the Natal Technical College. This Committee, in co-operation with the South African Sugar Technologists' Association Technical Education Committee, made specific recommendations to the Sugar Association for sponsoring the proposed three year training course. These recommendations have been accepted and the course commenced at the beginning of February and continued to the end of May. The course was well attended and should serve a useful purpose in training young men to take up technical posts in the Sugar Industry. Steps are being taken to have the course recognised by the Union Department of Education and it is hoped it will be possible to arrange for the issue of a National Diploma to students successfully completing the course.

* * *

London Terminal Market[1].

On various occasions since the re-opening of the London Terminal Market in January, 1957, the contract has been seen to be vulnerable, especially in the prompt month, to pressure arising from deliveries of non-Commonwealth sugars at times when these could not readily be absorbed by refiners. A corrective step was taken in January, 1958, when, apart from Commonwealth sugars, tenders were limited to those produced in Cuba, Haiti, the Dominican Republic and Taiwan. Recently, however, the situation has again arisen where the near months have been depressed at times well below World Market levels by deliveries in bags, which have proved an embarrassment to receivers.

The Association has now formally adopted a new contract based exclusively on preferential duty sugars c.i.f. U.K. Trading will commence on 1st October 1959. Prices will continue to be based on bagged sugar with the option to tender in bulk at the ruling discount. Delivery ex-store is to be eliminated and in most respects the contract will be based on the standard London Sugar Association terms for raw sugar. The existing contract will, of course, continue to be traded for as long as the need exists.

It is thought that such a contract will be welcomed by Commonwealth producers, U.K. refiners and other users and, since, with the elimination of fluctuations arising from purely local conditions, it will accurately reflect world sentiment, and it is hoped that it will prove widely attractive to the sugar trade both in this country and overseas.

* * *

Canada & Dominion Sugar Co. Ltd. 1958/59 Report.

The new Toronto refinery commenced melting on the 21st May and within 36 hours packaged refined sugar was coming off the production lines. This was the culmination of many years of planning and over two years of construction with an estimated cost of $1·4 million. Raw sugar cargoes direct from Mauritius and the Caribbean are being discharged at the Toronto dock, and an average daily production of 650 tons of refined sugar is scheduled. This capacity can be doubled or trebled as the growing market in the area warrants. Raw sugar is stored in an 80,000-ton shed known as "Redpath Church" because of the cathedral-shaped roof, and is drawn off through floor hoppers. The raw sugar after affination and melting is limed and carbonatated, followed by filtration through Sweetland pressure filters. After decolorization through bone char the fine liquor is boiled to refined sugar in stainless steel-lined pans of 30 tons capacity. The white centrifugals used are 1200 r.p.m. Western States machines with automatic operation, regenerative braking, etc.

In addition to the new refinery, Montreal refinery and Chatham beet plant have been modernized and Wallaceburg factory is being modernized for the 1959 beet crop. Encouraged by Federal Government price support, sugar beet plantings in 1958 were increased to 34,507 acres, and the yield of 14·65 tons/acre was a record.

[1] C. Czarnikow Ltd., *Sugar Review*, 1959, (418), 133; (423), 153.

THE SUGAR CANE IN MAURITIUS

IN June 1958 a Congress of the Technologists of the Mauritian Sugar Industry was held under the auspices of the "Société de Technologie Agricole et Sucrière de l'Ile Maurice". It was the first Congress to be held in the island and a full report of its proceedings has now appeared[1]. Attendant at the proceedings were representatives of South Africa, Madagascar and Réunion. The papers dealing with the agricultural aspects are reviewed below.

The objectives of 175 experiments being conducted at the time were reviewed by G. ROUILLARD. They cover a very wide field including nutritional studies, with reference particularly to N and P; comparisons of organic and mineral fertilizers; cultural operations, including overhead irrigation; field control of pests and diseases and, forming over a third of the number, variety trials. Those concerning N and P are dealt with in separate papers. The problem of providing adequate N while avoiding an excess, which would be uneconomic, is discussed by P. HALAIS. Foliar diagnosis has now been studied for some 25 years and has come to replace soil analysis as a guide to fertilization. The main object of the present paper, however, is to point out the desirability of taking into account the varietal differences which occur in the N leaf index. These may be considerable and the comparison is drawn between the fertilizer requirement of B 37172 with an optimum index 1·95 and Ebène 1/37 with an index of 1·75. The position with regard to P is more complex and is dealt with by D. H. PARISH and S. M. FEILLAFÉ. The complexity lies in the inter-actions between the phosphate and the soil covered by the words "fixation", "availability" and "reversion". P. HALAIS has demonstrated the fact that more than one-third of the cane lands of Mauritius are deficient in P, yet only 0·24 kg P_2O_5 per ton of cane is applied as compared with 1·2 kg N and 0·7 K—in cost, Rs/ton cane, P_2O_5 0·17, N 2·16 and K 0·70. The subject of adequate phosphatic fertilization is discussed on the basis of the acid and kaolinitic lateritic soils common in the island, the facts that the standard phosphatic fertilizer is guano and that deficiencies may appear in the ratoon crops. The conclusions drawn are that, in the case of marked deficiency, guano should be applied at the rate of about 1 ton per acre and that, since it carries P in insoluble form, it should be thoroughly incorporated in the soil. For ratoon crops, some form of soluble phosphate is desirable.

VARIETAL STUDIES

In the discussion on the problem of the varieties of cane in Mauritius, P. O. WIEHE reviewed the varietal changes which have taken place in the past 125 years, discussed the causes which have led to these changes, and outlined the probable future trend. Until the end of the last century noble vareties of foreign origin alone were cultivated. The introduction of hybrid canes promised a bright future for increased production from more and ever more vigorous, varieties, but the problem of the "running out" or "varietal degeneration" has intervened and the breeders' primary effort at the present time may be said to be, with some degree of truth, to provide a new variety of equally acceptable economic value when the standard variety shows definite symptoms of degeneration. Emphasis is laid on the interplay of mutations both of the host and the pathogene. The breeding trials, covering some 10 years between the initial cross and the release for commercial propagation, form the foundation of the programme and the future is visualized as a larger number of varieties under commercial cultivation, each selected for a particular locality. Probably an appreciable increase in yield would result if the present varieties were adequately distributed.

Varietal evaluation, together with comparisons between fields and between cultural systems, was approached by E. HUGOT from another angle. The criterion hitherto used has been the weight of recoverable sugar per unit area. This does not take into account the costs and he supplied a formula, including such items as fixed and variable charges both for field and factory, under which the criterion becomes the net profit.

PESTS AND DISEASES

J. R. WILLIAMS gave a summary of the varied aspects of the entomological problems met with in the islands. Probably there are many more than the 40 insects and invertebrates now known, which feed on cane, particularly among the soil fauna. Brief accounts were given of the stalk borer (*Proceras sacchariphagus*) and other borers, the leaf hopper (*Perkinsellia saccharicida*) and the white grub (*Clemora smithi*).

Experiments carried out at the Experiment Station, Mount Edgcombe, on the effect of heat treatment on germination of cane setts were described by G. M. THOMSON of Natal. These experiments cover two varieties, Co 331 and N:Co 310, and throughout, the latter proved the more resistant. Buds of medium age were found to be slightly superior to young buds and decidedly superior to old buds. Time (½–4 hrs) and temperature (49°–53°) both showed an increasing harmful effect, total failure to germinate being reached at 1 hr and 53° in the case of Co 331 and at 3 hrs and 53° in the case of N:Co 310. Thick canes are slightly less affected than thin ones.

TCA and sodium chlorate have not proved universally successful in controlling *Cynodon dactylon* and *Phalaris arundinacea*. Certain experiments, described by E. ROCHECOUSTE, suggest that efficacy is linked with the seasonal stage of the plant's growth.

TRANSPORT

In the last 11 years rail transport of cane has dropped by about 50% and road transport increased almost threefold. The economics of the two systems

[1] *Rev. Agric. Sucr.* (Mauritius), 1958, **37**, Nos. 4, 5 and 6.

together with suggestions for future development were detailed by F. NORTH COOMBES. The major suggestions are the replacement of steam by diesel locomotives and the limitation of rail transport to cane grown near the factory. Efficient road transport requires tractors and trailers or diesel engined lorries of 7–8 tons capacity with, accessory to these, an automatic loading system in the field and adequate unloading facilities at the factory.

CYCLONES

After an interval of 12 years, Mauritius was struck by two cyclones in 1958. A somewhat complex system of evaluating the damage done was described by A. DE SORNAY on the basis of which he places the major varieties in decreasing order of resistance as follows: B 3337, M 147/44, B 37172, M 31/45, M 134/32, B 34104, B 37161 and Ebène 1/37.

H. M.-L.

AGRICULTURAL ABSTRACTS

Improved Germination of Hot Water Treated Cane. J. H. BUZACOTT. *Cane Growers' Quarterly Bull.*, 1959, **22**, 93, 94.—Older cane of certain varieties is found to germinate much better after hot water treatment than younger cane and this has to be reconciled with the fact that moisture in the soil at the later date is often deficient. An inexpensive remedy is to water prior to planting from a tractor-drawn, 44-gal water drum which is sufficient for 10 chains.

* * *

Effect of Inorganic and Organic Nitrogenous Manures on Germination of Sugar Cane. R. MUTHUSWAMY. *Indian Sugar*, 1958, **8**, 499–506.—With a low moisture index, ammonium sulphate alone depresses tillering, millable cane and yield. 100 lb N as 40 lb organic and 60 lb inorganic gave a higher yield than any mixture with a higher % inorganic.

* * *

Possibilities of using Kardi Cake as a Manure. H. P. SINGH and N. S. SINHA. *Indian Sugar*, 1959, **8**, 613–617.—Nitrification takes place slowly in the case of Kardi cake, derived from the seed of the safflower, *Carthamus tinctorius*, of which considerable supplies are available at the oil mills of Uttar Pradesh. It becomes satisfactory if the cake is mixed with sulphate of ammonia.

* * *

The Mobility of Nitrate Nitrogen in the Soil. G. K. ZENDE and P. N. KALBHOR. *Ind. J. Sugar Cane Res. Dev.*, 1958, **3**, 1–9.—Both lateral and vertical movement of nitrate nitrogen was derived from various nitrogenous fertilizers, inorganic as well as organic, delivered as a band at 4 in depth.

* * *

The Effect of the Application of Molasses Solution through Foliage on Quality. C. S. SEN. *Ind. J. Sugar Cane Res. Dev.*, 1958, **3**, 29–31.—Four to five sprayings of molasses solutions ranging from 5%–20% during the growing period produced highly significant results on Pol % juice.

* * *

Outstanding Cane of Bihar. K. L. KHANNA. *Ind. J. Sugar Cane Res. Dev.*, 1958, **3**. 33–39.—In this third of the series, B.O.11, a high sucrose variety, is described and illustrated in considerable detail.

* * *

Soils of the Sugar Cane Districts of Negros Occidental. M. M. ALICANTE and A. BARRERA. *Sugar News* (Philippines), 1958, **34**, 679–688.—The soils are discussed at some length in their relation to climate, altitude and capacity to yield sugar.

* * *

Sugar Cane Mosaic Again on the Increase. I. L. FORBES and R. J. STEIB. *Sugar Bull.* (La.), 1959, **37**, 122.—A generation has passed since the last serious outbreak of mosaic and memories are short-lived. A warning is, therefore, desirable. In recent years the varietal resistance which brought the earlier attack under control appears to be breaking down, perhaps through the evolution of a new strain. The precautions it is now desirable to take are briefly stated.

* * *

Recommendations for Johnson Grass Control in Sugar Cane. E. R. STAMPER and S. J. P. CHILTON. *Sugar Bull.* (La.), 1959, **37**, 123, 124.—A programme is given for the treatment of plant cane, shaved (plant) cane and stubble cane.

* * *

Rôle of Railroad Transportation in the Sugar Industry. M. MENDEZ. *Proc. Philippines Sugar Tech. Conv.*, 1956, 32–37.—The importance of rail transport in carrying cane and sugar is briefly discussed, and an account is given of recent work of the Transportation Dept. of Victorias Milling Co. on chemical weed control, crushed rock ballasting, use of creosoted ties, and the use of hollow concrete blocks in bridges.

* * *

Sugar Cane Transportation in Taiwan. WAN-CHUN HSU. *Sugar J.*, (La.) 1959, **22**, (9), 7–11.—Tranport from field to rail is still mainly by ox-drawn carts loaded with cane bundled by hand. But the process is being rapidly mechanized and the systems under trial are described and illustrated. They include mechanical loading in the field, tractor haulage and crane-operated transfer to rail trucks. Certain data of both cost and labour requirement are given.

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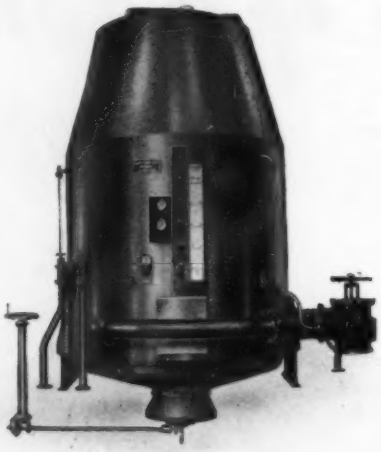

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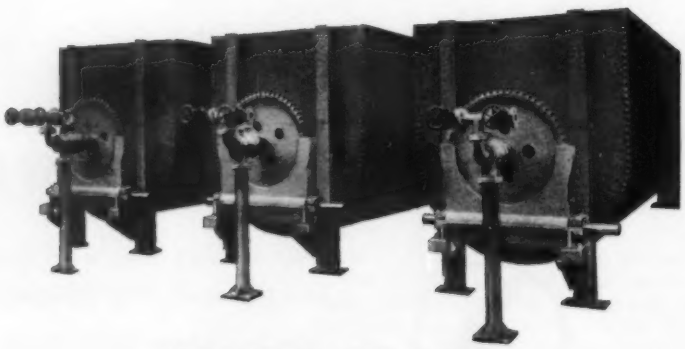

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SUGAR CANE AGRICULTURE IN JAMAICA[1]

THOUGH the density of population in Jamaica is only some 350 per square mile, much of the island is mountainous and uncultivable; industrial development, too, though on the increase, is low. The pressure which would normally depress wages under such circumstances is relieved by emigration and there exists both a shortage of skilled workers and a steadily rising cost of labour. This is, perhaps, the dominating economic fact of the Jamaican sugar industry and several papers deal with its repercussions on that industry.

T. CHINLOY and I. DE F. SMYTH, under the title, "Some Aspects of Sugar Cane Agriculture Operations", compare a series of standard operations as conducted on five selected estates, summarizing the results in terms of tractor- or man-hours per acre. Considerable inter-estate differences are disclosed. Thus tractor-hours consumed in deep cultivation range from 0·88 to 8·0 and, in total operations including furrowing, from 2·28 to 7·8 when trash is burned and from 3·38 to 14·13 when trash is unburned. The two high figures of 8·0 and 14·13 in the above refer to an estate on which the "Gyrotiller" is used; other differences, as in deep cultivation, are in part due to the nature of the operation, whether by knifing, ripping or deep ploughing, the method chosen depending in some measure on local conditions.

The subject is approached from another angle by G. F. CLARKE who describes briefly the lines of development, both in operation and form of implement that mechanization may be expected to take, as based on experience in other countries. In particular, he anticipates a certain loss of efficiency and an end to cultivating the steeper slopes.

The performance of tractors of different ages is the subject of a paper by J. A. WILLIAMS. There are several basic considerations entering into attempts to keep down tractor costs, such as planning to reduce to a minimum the movement from job to job, but maintenance is the largest single factor in operating costs and here the lack of skilled workmen is keenly felt. The reduction of such costs is attained by attention to lubrication and field checking. and by the provision of spare parts and good workshop facilities.

Proper maintenance of drains is of the utmost importance and C.H. F. CORFIELD describes a ditcher of his own design which has been well tested and adds to the description notes on proposed improvements.

The use of herbicides may now be considered a standard operation and the practice at Frome, and the conclusions drawn from experience of their use, form the subject of a paper by D. B. CAMPBELL.

Sugar Cane Varieties

Economic conditions, involving the possibility of a quota, have led to a general reduction in the planting programme, with consequent effect on the varietal position as indicated by C. E. M. SMITH. Extension of the acreage under B 41227 and B 4362 suffered thereby, yet these occupied 50% of the acreage reaped; but the acreage under B 3439 and B 34104 decreased respectively by one-third and one-half. The review of the commercial variety position is followed by a brief résumé of variety trials up to and including members of the B 52 series.

The commercial value of a variety depends on a number of factors, of which cane yield and, to a certain extent, quality are the integration of the environmental conditions. But other factors, such as quantity of juice, itself linked with fibre content, also enter into the question, as do the suitability of the residues for the manufacture or extraction of side products. The study involved may be termed that of the milling quality and is discussed by T. O. ELLIS, P. E. ROHRIG and G. ARCENAUX of Central Romana, Dominican Republic. They work out a variety correction factor (V.C.F.) integrating the effects of the varietal characters influencing the indicated yield of sugar as ordinarily calculated from primary juice analyses, using POJ 2878 as base (=1·00). In two cases only does the V.C.F. exceed that of POJ 2878.

A preliminary trial in crop logging is recorded by H. M. THOMPSON. It covered 124 fields, the leaf being used for the determination of mineral status and the leaf sheath moisture as the basis for measuring stem elongation and the influence of rainfall and irrigation. The data cover four monthly periods from 3 to 6 months' age (ratoon crop) and subsequently at 7½, 9 and 10½ months. In general, the fields selected were in good heart and showed little response to additional fertilizer dressings.

H. M.-L.

Bagasse—For Marcotting Cane Stalks for Breeding. B. A. BOURNE. *Sugar J.* (La.), 1959, **22,** (9), 13–16.—The material used for marcotting is usually Sphagnum moss, but it is apt to be in short supply. Air-dry bagasse, subsequently saturated with water proved unsuitable owing to rapid fermentation but bagasse pith, a by-product of the mill, or ground whole bagasse were found to be satisfactory and far cheaper than moss. Numerous additives were tried and ultimately a solution of 1% calcium nitrate and 0·2% sodium peroxide, or of the latter alone, was adopted for saturating the bagasse.

* * *

New Method for Sub-surface Drainage. ANON. *Sugar J.* (La), 1959, **22,** (9), 19.—A brief description is given of a new vinyl perforated tube devised by the Caterpillar Tractor Co., which is laid behind a subsoiler. Cost is 7–10 cents per foot compared with a normal 25–32 cents.

[1] *J.A.S.T.J.*, 1957, **20.**

How Should Land Drainage be Done? J. GORDON. *S. African Sugar J.*, 1959, **43**, 227, 229, 259.—A popular description is given of the principles underlying a system of drainage; but of greater interest, perhaps, is the origin of the need for drainage. This lay, in the particular case discussed, in the failure to secure the increased yields normally following trash blanketing. With a local rainfall well above the average, water-logging occurs beneath the blanket and checks growth of young ratoon shoots.

* * *

Mechanical Demonstration at Renishaw. ANON. *S. African Sugar J.*, 1959, **43**, 241–245.—A number of implements are described including an Evans loading crane straddling the tram-line and capable of loading 54 trucks per day. It may be fixed or rendered mobile for work in the field. Machines for spreading weedicides and the Don two-furrow planter were also demonstrated.

* * *

Notes on the Irrigation of Sugar Cane by Overhead Methods. A. C. BARNES. *S. African Sugar J.*, 1959, **43**, 297–301.—The system described is one of high pressure, high volume, rotating rainers covering circles of some 300 ft diameter or more in calm air.

* * *

Sugar Cane Borer and Loss in Louisiana. L. J. CHARPENTIER *et al. Sugar Bull.*, 1959, **37**, 154.—In 1958 joints bored ranged from 35% to 11% with an average of 19%. The estimated loss was $6½m.

* * *

Raw Rock Phosphate for Acid Soils. ANON. *Victorias Milling Co. Expt. Sta. Bull.*, (Philippines) 1959, **6**, (2), 3.—Florida rock phosphate contains some 30% P_2O_5, not so readily available as that in superphosphate nor so easily fixed in the soil. Evidence from acid soils with high phosphate-fixing capacity indicates that a dressing of 300 kg/ha every third year resulted in yields equal to those from 100 kg/ha superphosphate annually with a saving of some two-thirds on cost of fertilizer plus cost of application.

* * *

Cane and Sugar Production and Rendement Trends. A. HILADO and F. A. BASILA. *Victorias Milling Co. Release* (Philippines) ,1959, (21), 9 pp.—The period covered here is the 11 post-war years, 1946/47 to 1956/57. It falls into two sections ; 1946/47 to 1951/52, characterized by lower cane yields, and 1952/53 to 1956/57, with increasing cane yields but slightly lower piculs sugar/ton cane. On balance, over the 11 years, cane and sugar increases are 32% and 30% respectively.

A Preliminary Report on Trichogramma Parasites for the Control of Sugar Cane Moth Borers. P. H. PORQUES. *Victorias Milling Co. Release* (Philippines), 1959, (22), 5 pp.—Latest data are given of the release of *Trichogramma australicum* and *T. japonicum* for the control of the borers *Diatraeae infuscatella*, *Argyroploce schistaceana* and *Sesamia inferens*. The annual releases for 1956, 1957 and 1958, respectively, have been approximately 5·5 m, 115·7 m and 404 m. Former infestation was of the order of over 20% (% tillers infected); for the last two years it has been 4·60% and 4·65%.

* * *

Studies on the Nematode Soil Fauna of Sugar Cane Fields in Mauritius. J. R. WILLIAMS. *Occ. Paper Mauritius Sugar Ind. Res. Inst.*, 1959, (2), 9 pp; (3), 29 pp.—The two papers follow an earlier Occasional Paper[1] and deal with the strictly taxonomical details of the genera and species of the two families Belondiridae and Dorylaimidae, respectively.

* * *

Vigour of Germination of Rubbed and Graded Sugar Beet Seed. R. W. SHEPHERD and P. N. HARVEY. *Experimental Husbandry*, 1959, (4), 1–6.—Results are given of trials carried out in Norfolk during three seasons (1952–4) to compare the vigour of growth throughout the season of sugar beet plants grown from untreated seed clusters (natural seed) and different grades of seed with a proportion of the husk removed by mechanical treatment (rubbed seed). Large rubbed seed gave 20% more single plants with 5–10% lower germination but yields of root at harvest showed no significant differences. Results indicated that plants grown from the standard commercial rubbed seed were as vigorous as those from untreated natural seed. Germination of the smallest grade of rubbed seed averaged no more than 40%, but 80% of the viable clusters produced only one seedling.

* * *

Some Canes damage less from Hurricanes. L. P. HEBERT and R. J. MATHERNE. *Agric. Res. Wash.*, 1958, **7**, 14.—Observations made in Louisiana after a severe storm showed that N:Co 310 suffered the least damage and C.P.44–101 the most, other varieties being intermediate. Observations on controlled breakage showed that breaking 20% of the stalks in late August reduced cane yield by 5% and sugar yield by nearly 10%. Breaking 100% of the stalks caused losses of 35% and 54% respectively.

[1] *I.S.J.*, 1959, **61**, 196.

STARCH IN CANE JUICE CLARIFICATION

By M. C. BENNETT* and N. O. SCHMIDT†

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PART I

The Effects of Starch on Flocculation and Sedimentation

THE presence of starch in cane juice has been reported on a number of occasions during the last thirty years[1] but it is only recently that quantitative estimations have been carried out[2,3,4,5]; quantities up to 460 mg/litre have been found[3]. While it is generally agreed[6,7] that starch has a pronounced effect on the viscosity of syrups and molasses and on the filtrability of raw sugars, there is no evidence to suggest that starch affects sedimentation rates and mud volumes at the clarification stage. The view that starch is without effect upon the flocculated material in cane juice is supported by the finding[8] in this laboratory that an addition of 400 mg/litre of cassava starch produced only a slight change in the sedimentation behaviour of a normal juice.

However, in 1957 it was shown[9] that a large concentration of a potato starch (added as the powder to the raw juice) prevented the formation of discrete flocs on liming and boiling, so that no sedimentation could be detected for a considerable time. This finding is inconsistent with the fact that potato starches have found use as flocculants in coal-dust slurries[10] and other mineral suspensions[11,12]. In these systems the potato starch is added as a solution; potato starches have been found to be the most active and this has been attributed to their high phosphate content[12].

When a potato starch solution was added to a limed and boiled cane juice an extremely large increase in floc size took place and this was accompanied by a correspondingly large increase in sedimentation rate of the flocculated material. As an illustration of the magnitude of the effect, it was subsequently found that an addition of 350 p.p.m. of starch increased the initial settling rate in one juice from 0·8 to 22 cm/min, i.e. nearly 30-fold.

Clearly there is need for an investigation of the various effects of different starches during the clarification of cane juice. It is the purpose of the present paper to demonstrate the three main types of starch interaction found in flocculated cane juice systems and to compare the effects of an "active" potato starch with those of natural cane starch.

Experimental

Cane was milled in a laboratory 3-roller mill and the juice obtained was filtered through cotton wool in order to remove coarse material. Sufficient phosphate and calcium was added to ensure a clear clarified juice and the mixture adjusted to pH 8 with sodium hydroxide. Samples were boiled for not less than five minutes before they were poured into the settling tubes which have been described elsewhere[13]. Sedimentation behaviour was assessed in terms of V (the initial settling velocity), K an empirical constant also having the dimensions of velocity) and H_∞ (the percentage mud volume). The calculation and significance of these terms are also described in the previous paper[13].

Starches were added both as the powder and as the aqueous "solution"; solutions were prepared by pouring a starch-water slurry into boiling water and continuing to boil the mixture for a further 1–2 minutes with frequent shaking or stirring. In the work described below, the effects of these different forms of addition are compared when they are made both to the raw juice before liming and boiling and to the limed and boiled juice before pouring into the settling tube. Each effect is changed if the system is broken down in a high-speed blender for 30 seconds before pouring into the settling tubes, and juices treated in this way will be described by the term "blended".

Results

The curves for V, K and H_∞ against concentration of potato starch in a B4098 juice are shown in figures 1, 2 and 3; the starch was added after liming and boiling, i.e. just before juice samples were poured into the settling tubes. The four sets of experimental results shown in each figure represent the effects of starch powder and starch solution, each with and without blending. It is seen that by far the largest effect on V and K is produced by starch solution with the system not blended, while the greatest effect on H_∞ is produced by starch powder with the system not blended. Irrespective of the form of addition, blending yields identical V, K and H_∞ curves.

Approximate measures of the floc sizes produced by an addition of 350 p.p.m. starch are compared with those in the untreated juice, in Table I.

Table I. Effect of Starch on Floc Size

System	*Approximate floc diameters*
No added starch	1–3 mm
350 p.p.m. starch added as powder	1 mm
350 p.p.m. starch added as solution	10–30 mm
350 p.p.m. starch blended	5–10 mm

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[1] MARTIN in "Principles of Sugar Technology", ed. HONIG, (Elsevier, Amsterdam) 1953, p. 188.

[2] BALCH: *Sugar J.* (La.), 1953, **15**, (8), 11; *I.S.J.*, 1953, **55**, 191.

[3] ALEXANDER: *Proc. 28th Congr. S. African Sugar Tech. Assoc.*, 1954, 100; *I.S.J.*, 1955, **57**, 115, 146.

[4] NICHOLSON and HORSLEY: *I.S.J.*, 1958, **60**, 260.

[5] BUCHANAN: *S. African Sugar J.*, 1958, **42**, 32; *I.S.J.*, 1958, **60**, 333.

[6] FORT and SMITH; *Sugar J.* (La.), 1954, **17**, (6), 18–21, 32; *I.S.J.*, 1955, **57**, 146.

[7] *Tech. Rpt.* (Sugar Research Institute) 1952, (8).

[8] SCHMIDT *et al.*; *Proc. B.W.I. Sugar Tech.* 1954, 171; *I.S.J.* 1957, **59**, 158.

[9] BENNETT: unpublished.

[10] HENRY: *French Patent* 658,306 (1928).

[11] EVANS *et al.*: *Canad. J. Chem. Eng.*, 1957, **35**, 25.

[12] LA MER and SMELLIE: *J. Colloid Sci.*, 1956, **11**, 710.

[13] SCHMIDT: *I.S.J.*, 1959, **61**, 263.

These effects have been found in every juice studied, though the magnitude of the effect varies from juice to juice. The maximum effect of the starch solution (not blended) in figures 1 and 2 above (i.e. V = 18 cm/min and K = 0·36 cm/min) is, in fact, quite small compared with the effect of this starch in other juices. For example 50 p.p.m. of starch added in this manner to a B 37161 juice gave V lying between 35 and 40 cm/min and K greater than 1·0 cm/min. The results quoted in the figures above were chosen because of the extremely poor sedimentation behaviour of the B 4098 juice in the absence of starch.

Other starches do not give such large effects as those described here for a particular potato starch (A). A comparison of effects of four different starches on the sedimentation in a B 4098 juice is made in Table II, where the total phosphate content of each starch is also given. The starches were added as solutions to the limed and boiled juice, just before settling.

Table II. Sedimentation Effects of Different Starches

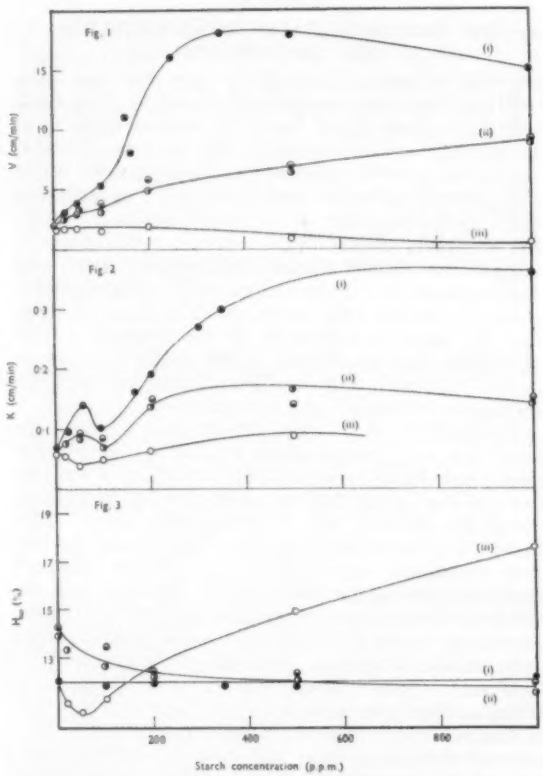
Starch	*Concentration (p.p.m.)*	*V (cm/min)*	*K (cm/min)*	*Phosphate (mg P/g)*
None	—	1·3	0·038	—
Potato A ..	50	5·0	0·127	0·756
Potato B ..	50	3·2	0·064	0·600
Arrowroot..	50	1·5	0·061	0·158
Cassava ..	100	1·4	0·046	0·087

Starch powder added to the raw juice before liming or heating gives an effect similar to that of starch powder added after boiling, i.e. there is little effect on V or K but a large increase in H_∞. A graph of H_∞ against concentration of starch added in this manner is given in figure 4 which shows the effect of a potato starch on juices from BH 10/12 and B 37172 varieties and also the effect of a cassava starch on the B 37172 juice. The starch additions cover a very much wider range than those of figure 3, but it should be noted that the slopes of the graphs for the potato starch are the same. Additions of 6 g/litre (or more) of the potato starch yield systems of mud volume greater than 50% and since V and K fall to extremely low values (not shown here) it is clear that sedimentation in such systems cannot be detected for a considerable time.

When starch powder is added to the raw juice, the system limed, boiled and then blended for 30 seconds, the effect on sedimentation is the same as that shown for blended systems above. Starch solution added at any stage other than just before settling also yields an effect similar to that in the blended system above. It was subsequently shown that when the starch solution was added to a limed and boiled juice (i.e. in such a manner as to produce the largest flocs and the greatest settling rates) reboiling this system for periods greater than 1 minute led to a breakdown of the large flocs and a decrease in the V and K values. The settling effects produced after this treatment were identical with those of blending.

Discussion

The three types of settling effect produced by a starch are shown in each of figures 1, 2 and 3; from the observations of floc size reported in Table 1 it is clear that the effects are associated with three different types of interaction between the starch macromolecule and the particle system in juice[14,15].



Figs. 1, 2 and 3.

V, K and H_∞ against starch concentration in a B 4098 juice. Starch added to the limed and boiled juice, just before settling: ● (curve i) as viscous solution, ◒ (curve ii) blended; O(curve iii) as a slurry of the powder, ◑ (curve ii) blended.

It appears that the type of starch effect is dependent upon the following three factors :—

(1) *The stage of defecation at which the addition is made :*—Before liming or heating the starch can interact only with single particles and the initial effect will be similar to that produced in coal dust slurries; superimposed upon this are the flocculation processes of normal defecation. After liming and boiling, the starch can interact only with the preformed particle clusters (flocs) and the starch effect will be superimposed upon that of normal defecation.

(2) *The physical form in which the starch is added :*—The great difference between the effects of a viscous starch solution and the starch powder suggests that the effect of a given starch concentration in the juice

[14] Bennett: *I.S.J.*, 1957, **59**, 176, 208.
[15] Bennett: *I.S.J.*, 1959, **61**, 77, 109, 135.

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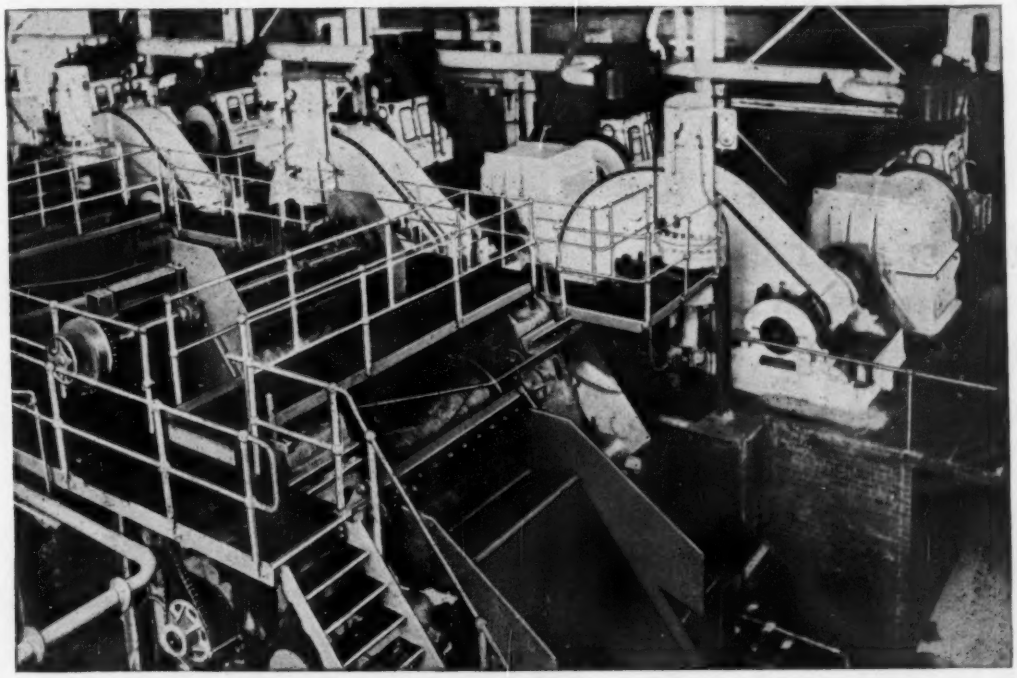

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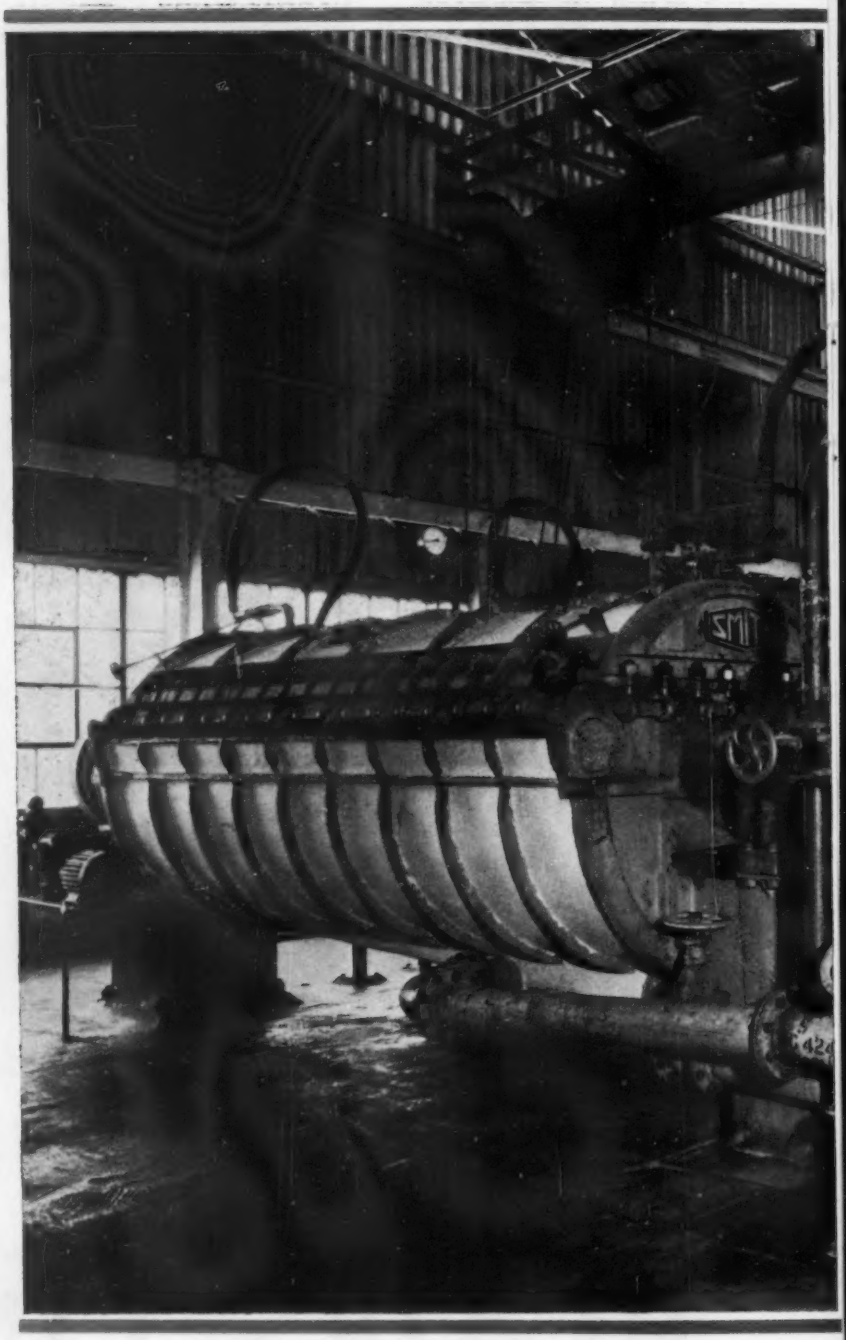

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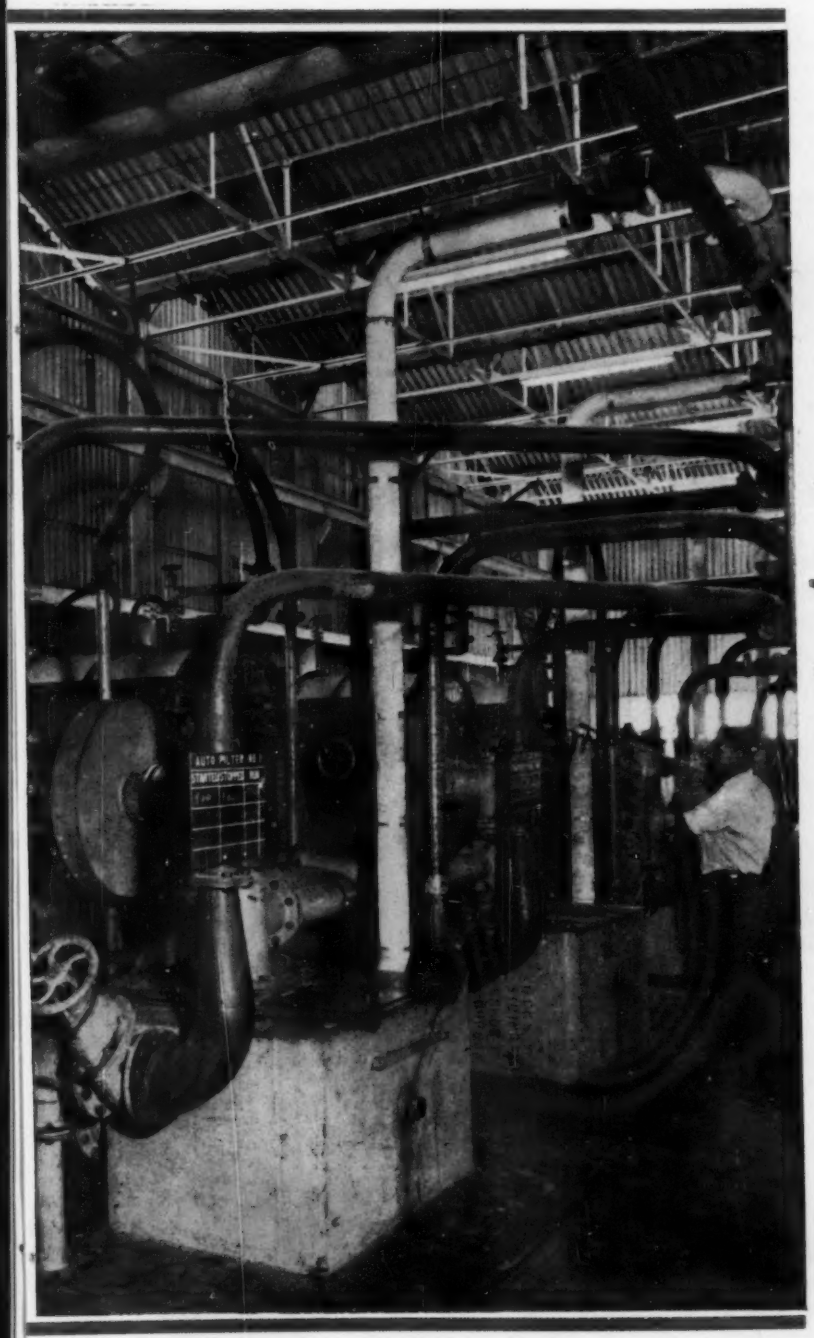

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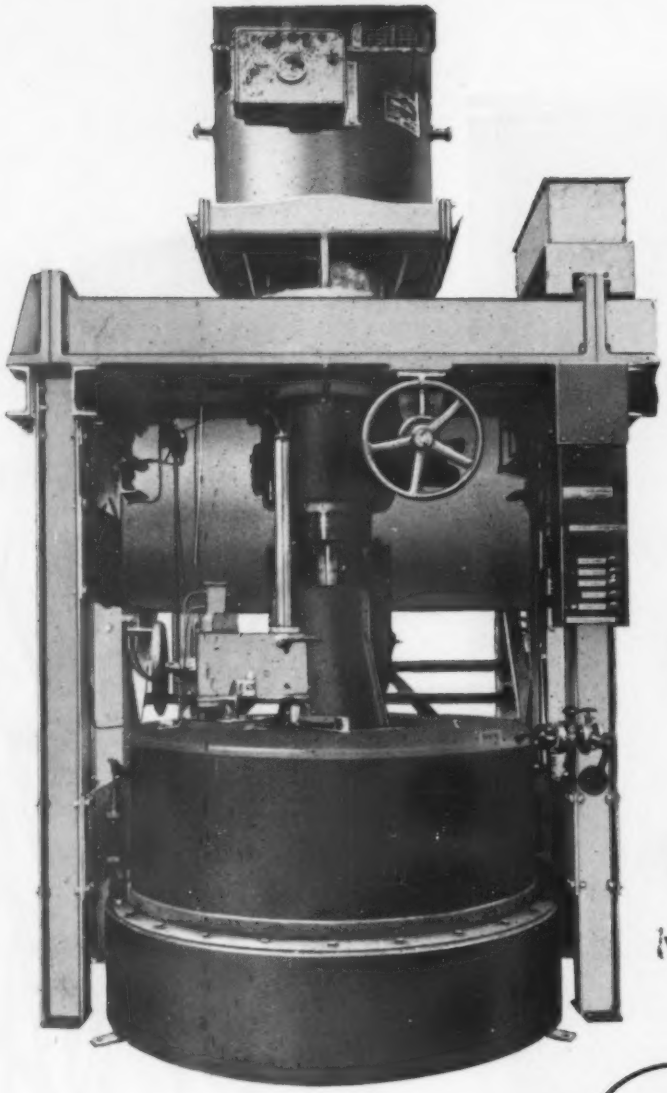

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depends upon the degree of aggregation in the interacting starch molecules. Evidence in support of this view will be put forward in Part II of this paper, where the mechanism of starch flocculation is discussed.

It is suggested that when a viscous starch solution is added to a defecated juice, interaction between starch molecular aggregates and juice particles takes place before the added starch has reached equilibrium with its new environment. It is assumed that large molecular aggregates do not form when starch powder is added directly to the juice so that the starch concentration never exceeds that required for the settling experiment.

(3) *The starch concentration in the juice :*—In figure 2 it is seen that curves (i) and (ii) show maxima at a starch concentration of ca. 50 p.p.m.; these K maxima are accompanied by points of inflexion in the V curves of figure 1. The results of a subsequent examination of these effects over the concentration range 0—250 p.p.m. (not shown here) suggest that the V and K curves (i) and (ii) are not continuous over this range and that the type of starch interaction changes when the concentration exceeds ca. 150 p.p.m. There is however no other evidence in support of this view.

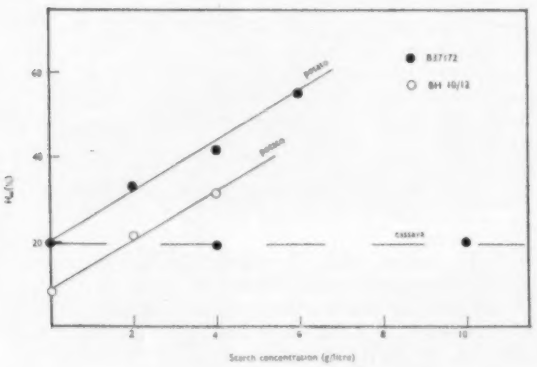

Fig. 4.

The effect on mud volume of large concentrations of an active potato starch and an inactive cassava starch. Starches added as a powder to the raw juice, system not blended.

At starch concentrations greater than ca. 150 p.p.m. it is clear that curves (i) and (ii) in each of figures 1, 2 and 3 represent the two extremes of starch effect. In one case (i) the effect is that of maximum flocculation in which it is imagined that a large number of particle clusters are agglomerated by interaction with large starch aggregates; in Part II it will be suggested that these aggregates act like "macro-molecular nets" in which preformed flocs are trapped. In the other case (iii), the effect is that of maximum stabilisation in which it is imagined that each particle cluster carries an adsorbed layer of unit amylopectin residues so that agglomeration of the clusters is hindered. The result expressed in figure 4 is consistent with this view.

The effect of blending indicates that the two extremes described above represent unstable arrangements between starch and juice particles. It seems reasonable to suggest that the stable arrangement which is independent of either the form of starch or the stage at which addition is made, lies somewhere between the two arrangements suggested above.

Observations on Natural Cane Starch

In a previous paper[15] it has been suggested that the gelatinization of naturally-occurring starch in cane juice is responsible for the flocculation observed when certain juices are heated over 60°C. In the light of the above discussion it is possible that this starch might also have a considerable effect on sedimentation in the defecated juice.

It is not possible to effect a complete separation of the starch from a raw juice and yet leave the juice otherwise unchanged; however, a partial separation of a large quantity of starch can be made simply by centrifuging[16]. Preliminary experiments have shown that, in every case, sedimentation rates of the defecated juices are lower after centrifuging. When the centrifuged starch-containing sediments are added to raw juices which themselves contain very little starch, sedimentation of the defecated juice is improved. The effects are very small compared with those produced by potato starch and typical results are shown in Table III where a B 4908 juice of high starch content is compared with a BH 10/12 juice of low starch content.

Table III.

The sedimentation of B 4098 and BH 10/12 showing the effect of B 4098 starch

Juice	*V*(*cm*/*min*)	*K*(*cm*/*min*)	*H*∞
B 4098	1·2	0·053	12·0
B 4098 without starch	0·9	0·041	12·1
BH 10/12	3·7	0·265	12·2
BH 10/12 + B 4098 starch	5·0	0·590	11·8

The conclusion that the cane starch in this B 4098 juice assists defecation is supported by the result of a complete exchange of particles between the two juices above. This was carried out by the "cold-clarification" technique described in an earlier paper[15] and the results, in Table IV, show that while the general clarification character of each juice is retained in the continuous phase, the B 4098 particles assist their own sedimentation.

Table IV. Particle exchange between B 4098 and BH 10/12

System	*V*(*cm*/*min*)	*K*(*cm*/*min*)	*H* (%)
BH 10/12	4·0	0·171	10·1
B 4098	1·2	0·050	13·5
B 4098 particles in BH 10/12 juice	6·0	0·660	9·5
BH 10/12 particles in B 4098 juice	0·8	0·038	14·1

These effects are the reverse of those obtained when potato starch is added as a powder to the raw juice. It is possible that the difference in action may be attributed to the great difference in starch phosphate contents: the low value of 0·114 mg P/g was determined on a sample of cane starch kindly sent by Mr. J. B. Alexander of the Sugar Milling Research Institute, Durban.

[16] Alexander: *S. African Sugar J.*, 1958, **42**, 579; *I.S.J.*, 1959, **61**, 116.

However, the effects of blending appear to be general for both cane and potato starches; the results of blending three starch-containing juices are shown in Table V.

It is of interest to note that these results are not consistent with the findings of DAVIES and YEARWOOD[17] or indeed with the generally accepted view, that once the defecation flocs are formed they should be treated as gently as possible in order to achieve optimum sedimentation. In the light of the above discussion it is concluded that this blending effect is associated with a rearrangement of starch and flocculated particles; once again, the effect is very small compared with that obtained using potato starch.

Table V. Effect of blending starchy juices

Juice	*V(cm/min)*		*K(cm/min)*
A	1·0	..	0·036
A blended	1·4	..	0·069
B.....	1·05	..	0·082
B blended	1·23	..	0·098
C	1·6	..	0·069
C blended	2·1	..	0·074

(*to be continued*)

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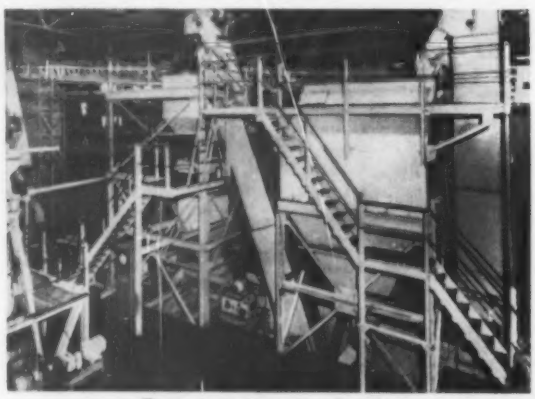
It is designed to process 540 tons of raw sugar daily and produces a refined sugar of high quality equally suitable for direct consumption or for use by local industries for the manufacture of sweets, soft drinks, etc.



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2. CO_2 Temperature recorder.
3. Lime density recorder and controller (Rotameter).
4. pH meters with recorders for 1st and 2nd carbonatation and sulphured liquor.

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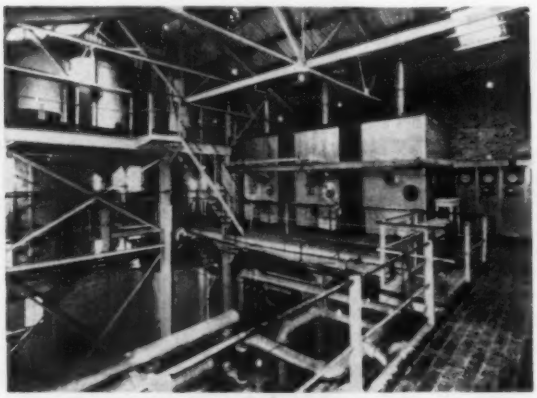
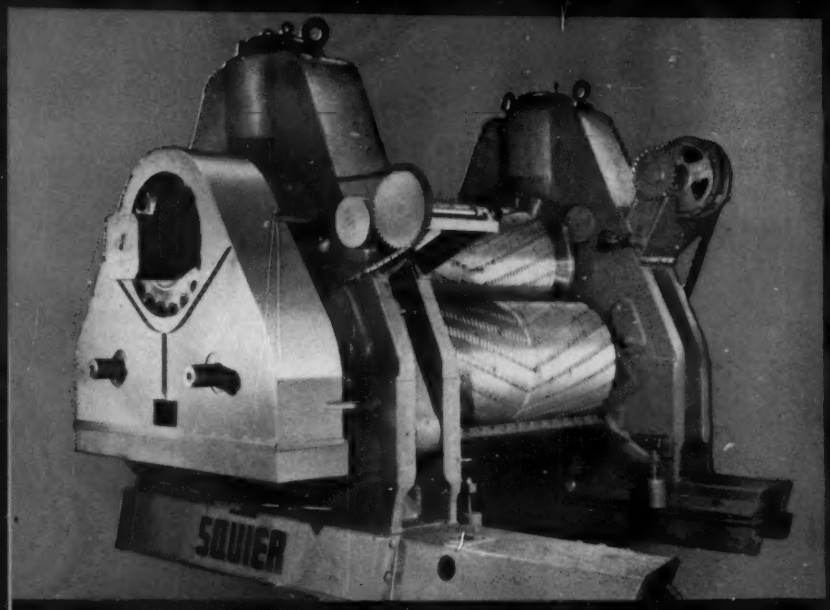
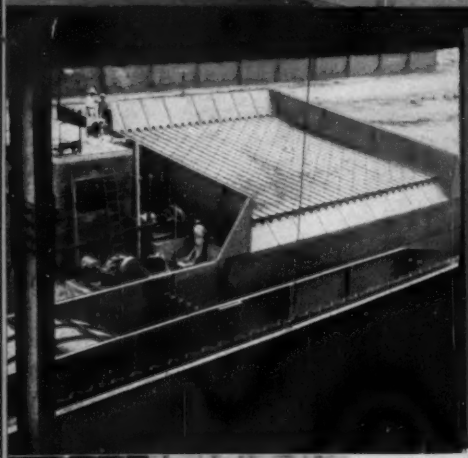
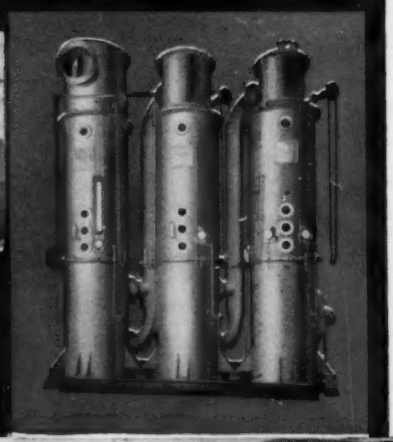


Carbonatation plant

[17] *I.S.J.*, 1941, **43**, 8; 1942, **44**, 246.







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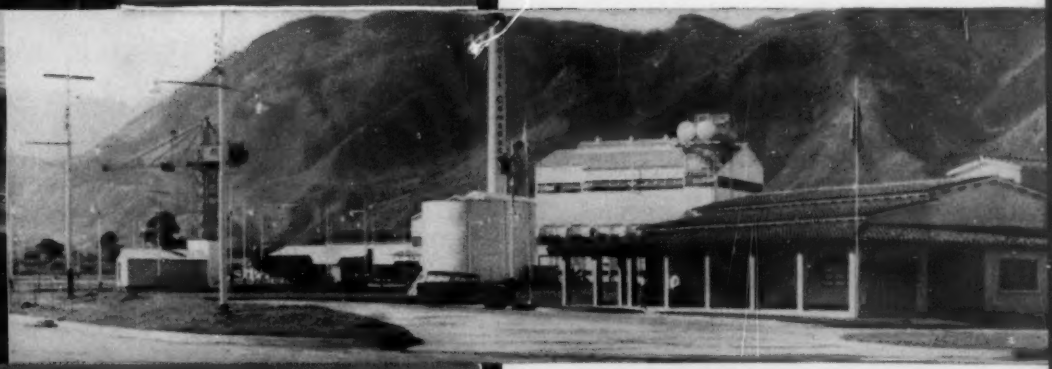

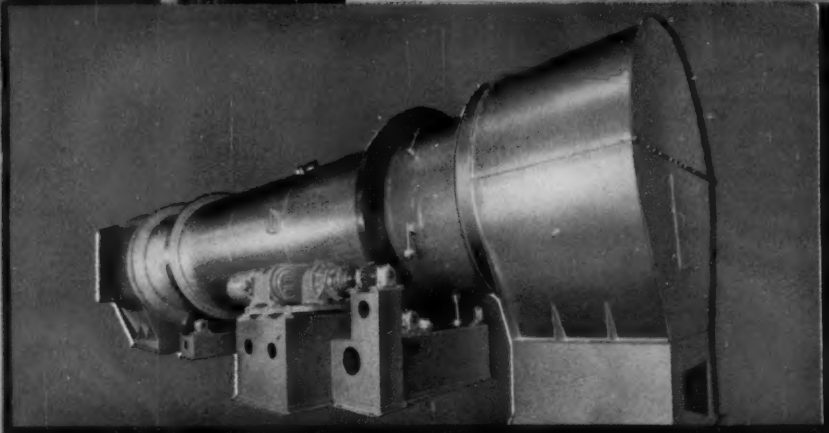

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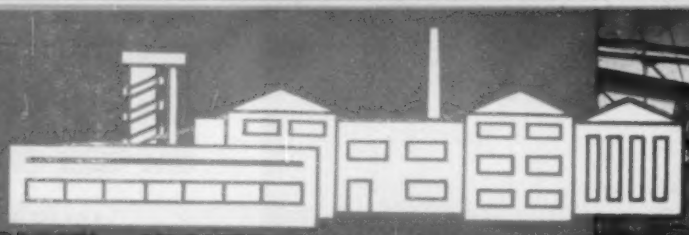

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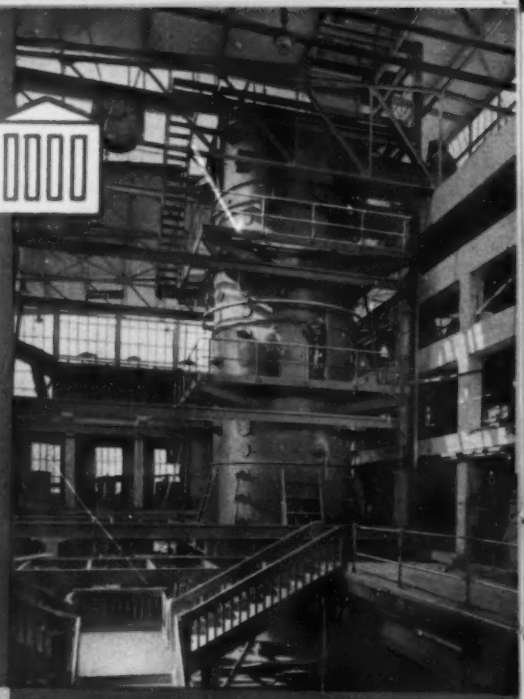

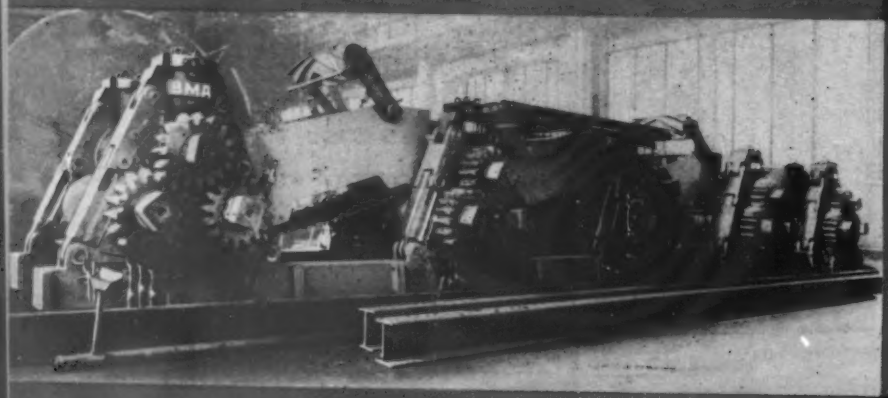

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1 beet sugar factory for Yugoslavia, as well as sugar refineries for Korea.

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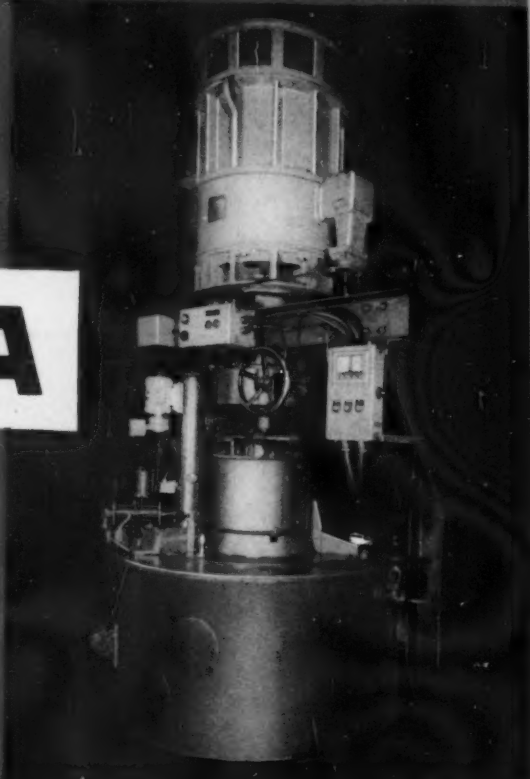

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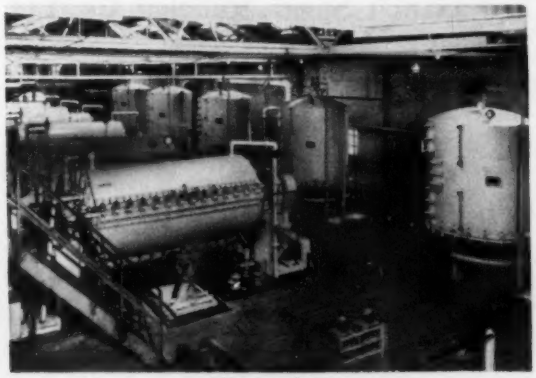
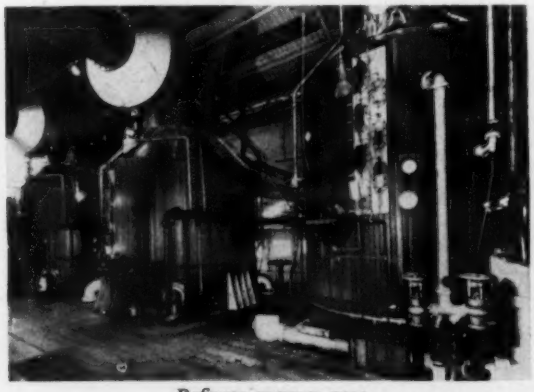
First carbonatated liquor at a pH of about 8·1 is heated to 160°F and filtered in "Autofilters" where the filtering cycle is normally 7–8 hours but cycle periods of up to 14 hours have been recorded. The filtering rate is 2·31 gallons/sq.ft. filter surface per hour. As a result of the high quality of the refined sugar produced by single carbonatation it has not so far been found necessary to use the second carbonatation plant, so the first filtrate is pumped to a continuous sulphitation tank and leaves at a pH of 7·0.



Filter station

Sulphured liquor is filtered in "Fas-Flo" filters and heated to the temperature of the liquor in the first vessel of the evaporator. A sealed-downtake type triple-effect evaporator of 6,000 sq. ft. heating surface concentrates the liquor from 48° to 65° Brix using steam at 5–7 p.s.i.g. Vapour is bled from the first vessel of the evaporator at about 2 p.s.i.g. for all liquor heating.

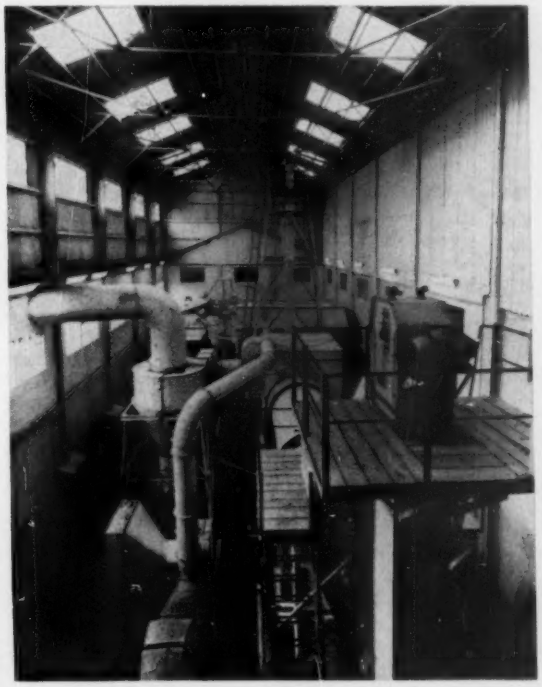


Refinery vacuum pans

Evaporator thick liquor is heated to 180°F and then filtered in "Fas-Flo" filters and pumped to pan supply tanks. Three white strikes are boiled and graining is done on melt for both the first and intermediate boilings; the intermediate massecuite is a mixture of virgin melt and first greens, and the final massecuite is boiled on greens only, the run-offs of this being returned to the raw house. The ratio of first and intermediate strikes to final strikes is 12 to 1.

Using 3–5 p.s.i.g. steam the 1,200 cu.ft. "Centre-Flow" pans boil a first or intermediate strike in 1¾ hours, the vacuum being 22 in–23 in; the final strike is boiled in 2 hours in a 600 cu.ft. " Centre-flow" pan under similar conditions of vacuum. Pans discharge into strike receivers and the massecuite flows by gravity to the mixer above a battery of seven 42 in × 24 in centrifugals which work on a cycle including 90 seconds spinning time.

The diameters of the discharge valves on the "Centre-Flow" pans were increased from the usual 24 in to 36 in for the 13 ft diameter pans and from 21 in to 24 in on the 6 ft 6 in diameter pans. The larger pans discharge 52 tons of massecuite in ten minutes.



Drying, storage and bagging plant

Refined sugar leaves the baskets at about 158°F and 2% moisture content and is elevated to a horizontal rotary dryer which discharges the sugar at 140°F and 0·04% moisture content. The sugar is bagged at 122–131°F. Refined sugar analysis shows an ash content of 0·006 to 0·01 (conductivity ash) and a colour index of from 16 to 21.

Provision was made in the plant supplied for separating wash and greens at the centrifugals, although this system is not at present in use. In the

event of having to refine poor quality high colour raw sugar it will be of advantage to be able to blow up and filter the wash.

The refinery was designed and manufactured by George Fletcher & Company of Derby with part of the plant being supplied by their South African agents, Patrick Murray (Pty) Ltd. of Durban, who also carried out the erection. The process was adapted from that used by the British Sugar Corporation for refining raw sugars in their factories between beet crops and both staff and designers of the Sezela Refinery were given valuable advice and assistance by Mr. J. CAMPBELL MACDONALD O.B.E., Chief Technical Officer of the Corporation.

FILTRABILITY OF RAW SUGAR

A Review of Recent Work Done by The Colonial Sugar Refining Co. Ltd.

By C. W. DAVIS, Chief Chemist, C.S.R. Co. Ltd., Australia.

PART I

DISCUSSION of means for improving the filtering qualities of raw sugars has become so widespread, and so many people in the Australian sugar industry have asked for news of the Company's progress with this matter, that this review of some of the Company's recent work is being published now. Much of the work is still proceeding, and is at the speculative stage at which one normally prefers to defer publication until firm conclusions have been reached.

Neither the importance nor the difficulty of solving this problem need emphasizing. We are all aware of the persisting differences in filtering qualities of raw sugars from various origins, both within Australia and overseas, in spite of the strong pressure for uniformity from the market.

Much information has already been published on this subject, and the present review does not attempt to summarize or abstract this information. Rather, it attempts to outline some of the thinking of the Company's staff in dealing with the problems that still exist to-day in this field.

A large volume of research and investigational work has been carried out by the Company's officers working on this problem over a number of years[1,2]. Much of this work has not been published but references are given throughout the text to that portion which has appeared in the literature.

Problems concerning filtering qualities of raw sugars arise when refinery filter cakes offer high resistance to flow of process materials. Accordingly, the review begins with investigations into the refinery carbonatation process. These investigations showed that the refiner could often improve the position. However, some raw sugars contained impurities whose effects he could not overcome.

This conclusion led us to investigate the insolubles in raw sugars and in the mill process materials whence the raw sugars were derived.

One offshoot from this investigation was a study of starch, which was known to be in many refinery filter cakes that showed high resistance to flow. The results led us to believe that starch blocks refinery filter cakes and also causes viscosity effects by the passage of its "soluble" portion through the cakes.

Another offshoot from the investigations of insolubles was a study of dextran, which we think spoils mill clarification and causes viscosity effects in the mill pans and centrifugals.

After considering the manner in which insolubles blocked refinery filter cakes, and after studying the mechanism of mill clarification, we think that soluble phosphate is also an undesirable impurity in raw sugars.

All the above considerations led us to investigate the simple and cheap lime-defecation clarification process used in Australian mills, and we found the process lacking in certain important aspects, and in need of re-design.

When the re-designed mill clarification process is in operation, some improvements in filtrability of sugars may reasonably be expected. This, however, is not the whole answer, and research is being continued, with particular reference to the possibility of extracting less of the undesirable impurities from the cane and also improving clarification and pan boiling.

The various subjects mentioned so far will now be discussed separately in the same order.

DEFINITION OF THE PROBLEM

The refiner's problem is presumed to arise when fine suspended matter clogs the filters, and/or "viscous" material impedes flow through the filters, resulting in reduced rate of work. This necessitates corrective measures by the refiner, such as the addition of more filter aid and of substances that aid clarification yet do not themselves filter easily.

The fine suspended matter, the "viscous" material, and components that precipitate during processing, will for the most part have come to the refinery in the sugar, and will form the major portion of the filtration-impeding impurities.

Thus for the purpose of attacking the problem we may consider the filtration-impeding materials passing to the refinery filter to be as follows :

(1) Insolubles in sugar.
(2) Solubles in sugar which become insoluble during refinery defecation e.g. soluble phosphates.

[1] HARMAN: *Rpts. Queensland Soc. Sugar Cane Tech.*, 1934, 7.
[2] HARMAN: *Proc. 5th Congr. I.S.S.C.T.*, 1935, 44; I.S.J., 1935, 37, 471.

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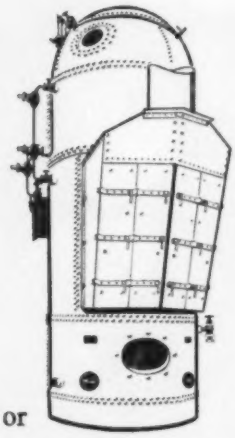

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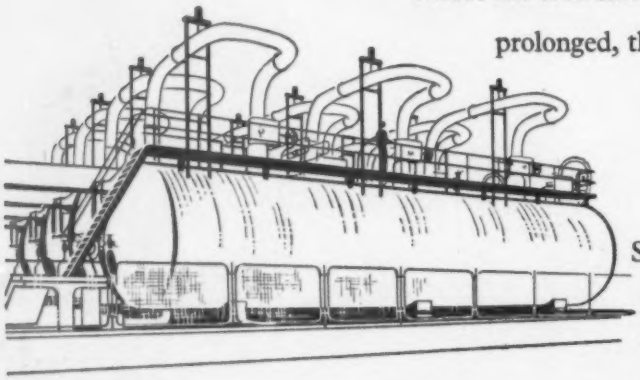

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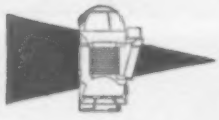

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(3) Material in sugar that affects viscosity at the filter station.
(4) Insolubles made in the refinery defecation process from materials added by the refinery e.g. phosphoric acid and lime.

The refiner's problem is the handling of these impurities at minimum cost, while persuading the miller to minimize classes (1), (2) and (3) in his product, (this in turn may be expected to reduce class (4) as a consequence).

The miller's problem, as distinct from the refiner's is to name the origin of filtration-impeding impurities, and evolve means of avoiding or eliminating them at a lower cost than is possible in a refinery.

In the mill, we may concentrate on the following problems :

(1) Extraction of unwanted impurities at the crushing station.
(2) Residual insolubles in clarified juice.
(3) "Solubles" in clarified juice which subsequently become insoluble (in evaporators and pans).
(4) Soluble phosphate and starch in clarified juice.
(5) Inclusion of unwanted impurities in sugar during boiling and crystallization.

From the above list, it can be seen that problems occur at the crushing, clarification, and pan stations of the mill.

Refinery Carbonatation Experiments

In recent years a considerable amount of work has been devoted in C.S.R. to the refinery carbonatation process. The work was substantially successful and parts of it were published by the Company[3,4,5]. This has resulted in improvement in filtration performance, particularly with difficult sugars. The carbonatation process was brought under much better control than previously, and the effect of chance variation reduced sufficiently to enable variations in sugar composition to be statistically correlated with variations in filtrability.

Our approach to this problem was to analyse filter cakes, and measure resistance of the cakes to flow.

It was found that the polysaccharide content and protein content of filter cakes varied with flow resistance, and from this it was argued that polysaccharides and proteins were blocking the cake and causing flow resistance. (The polysaccharides were probably mainly starch, which no doubt provided "insolubles" to block the filter cake and "solubles" to increase viscosity and so reduce flow rate.)

This work is an interesting example of an approach to the problem whereby we looked at particular named impurities. Subsequent thinking tended towards regarding such impurities as being merely members of the general class of suspended matter which clogged filters and sometimes also caused increases in viscosity.

This thinking led to a general study of insolubles in raw sugar, as described in the following section.

Before proceeding, it is appropriate to mention two points :

(i) Considerable work has been done on the flow resistance of filter cakes made from diatomaceous earth as well as those made from carbonatation slurries. We have found diatomaceous earth useful for checking and comparing the behaviour of sugars, since unlike carbonatation slurries, the particle size is fixed and does not change with variations in experimental conditions[6].

(ii) Damage of stored raw sugars by micro-organisms has also been examined[7,8]. These changes may only have a remote relationship to the filtrability, but are important in carbonatation, particularly in regard to colour removal.

Study of Insolubles in Raw Sugar

Many raw sugar samples have been examined, and a good correlation so far obtained between filtrability and percentage of insoluble solids. A typical example of this work is the case of two Queensland mills from which a total of 38 samples of raw sugar were taken. The arithmetic mean filtrability figures were 11% and 42% respectively, and the corresponding insoluble contents 0·084% and 0·023%.

Speculation on this subject leads one to ask whether some suspended matter may be more deleterious than other, and hence give different relationships between filtrabilities and suspended matter contents. This may well be so; nevertheless it is thought reasonable to assume that the removal of suspended matter will on many, and perhaps most, occasions improve the filtrability of raw sugars.

It is relevant to add here that various individual components of the suspended matter have been studied, and each found to correlate with the filtrability of the sugar. From time to time in the past this has led people to name the particular component being studied as the cause of filtration impedence, whereas we now think that the effect may be caused primarily by the size of the particles rather than their chemical nature. The validity of this conclusion is the subject of proposed research.

Study of Insolubles in Mill Clarified Juice and Liquor

Some investigations in mills have suggested that the amount of suspended matter in clarified juice correlates with the amount of suspended matter in the corresponding liquor and raw sugar, and also correlates with the filtrabilities of these materials.

This work is extremely difficult to perform, owing to the large number of variables. Suffice it to say that we expect insolubles in clarified juice to pass into the

[3] Aldrich *et al.*: *Pamphlet C.S.I.R.O.* (Australia), 1954, (72).
[4] Hertzberg *et al.*: *Proc. 4th Tech. Session Bone Char*, 1955, 53; *I.S.J.*, 1958, **60**, 269.
[5] Hertzberg and Mountfort: *Trans. Inst. Chem. Eng.* 1959, **37**, 5.
[6] Nicholson and Horsley: *Proc. 9th Congr. I.S.S.C.T.*, 1956. 271: *I.S.J.*, 1958,**60**, 105.
[7] Sherwood and Hines: *Proc. 7th Congr. I.S.S.C.T.*, 1950, 591. *I.S.J.*, 1952,**54**, 140.
[8] Sherwood *et al.*: *Proc. 8th Congr. I.S.S.C.T.*, 1953, 820; *I.S.J.*, 1954,**56**, 351.

raw sugar, although in varying degrees, depending on their nature and also on sugar boiling techniques. We also expect additional insolubles to appear during evaporation and sugar boiling, and likewise these may be included with the raw sugar in varying degrees.

Work is now proceeding to study the various classes of insolubles, find their origins, and find means of obviating their effects or removing them[9]. One branch of this work is described subsequently under "Clarification".

Starch

It is clear that we now regard starch as merely providing insoluble matter (to clog filter cakes) and some soluble material (which may increase viscosity). However, starch has earned a reputation as being associated with raw sugars of lower filtrability than expected from this simple statement. We think it likely that many raw sugars of high starch content also have a high content of soluble phosphate[10]. In the refinery the soluble phosphate forms calcium phosphate which clogs the filters and so accentuates the effect of starch. The extent to which this form of clogging is occurring, can be tested by numerous analyses of raw sugar, but this whole difficulty may be obviated by reducing the soluble phosphate content of raw sugar as suggested under a subsequent heading.

Another approach to the starch problem is to remove starch from mixed juice in the mill. This can be performed by some form of centrifugation or by the use of an enzymatic process developed by the Company[11]. In this process, the juice is maintained at 158°F for a period of up to 30 minutes. This allows the natural enzymes of the juice to depolymerise the starch, while not encouraging the action of dextran-forming organisms.

Dextran

In seeking causes for poor clarification, attention was given to dextran, as this substance is known to occur sometimes in sugar juices. We expected that it would act as a protective colloid, and inhibit coagulation and so cause fine suspended matter to pass out of the clarifiers with the "clear" juice.

Laboratory experiments confirmed that dextran has an extremely deleterious effect on clarification, and so the extent to which dextran occurs in the industry was investigated. The results revealed great variability of occurrence, and we concluded that when dextran occurs to a marked extent it is as an "epidemic", which comes quickly and goes quickly. It is therefore difficult to study.

Two lines of investigation then ensued : one to study the occurrence of dextran, and the other to study means for eliminating it or preventing its deleterious effects.

In spite of most extensive investigations, including special visits to major overseas centres dealing in dextran work, we do not know how to overcome completely the effects of dextran once it is in the factory. We do know, of course, that its content in juices increases rapidly if these are kept below 160°F, and when dextran type of infection is known to be present no factory material should be allowed to remain below this temperature. We also know that increasing clarification measures, such as adding extra phosphate, may help, but not sufficiently to avoid extremely bad clarification when dextran is present in large amounts.

We have speculated on the possibility of using the enzyme dextranase to depolymerise dextran, but this appears to be uneconomic.

This lack of success in handling dextran in the factory led us to concentrate on finding its origin, in the hope that its occurrence could be prevented. Here also great difficulties were encountered.

At first it was thought that dextran would not be a normal metabolic product of the cane, but would be made by an invading organism. This hypothesis proved untenable, and further work led to the conclusion that the dextran encountered by us was made by enzymes from the cane working in conjunction with enzymes from invading micro-organisms[12].

The practicability of controlling this process does not appear great ; nevertheless further work may be justified when dextran epidemics occur and after other possibilities for improvement of mill process have been explored.

In recent years dextran epidemics have not come to our notice and work in this direction is not being continued at present.

However, we would comment that the repeated occurrences of difficulties in pan boiling accompanied by high viscosities, following late season rain, may be due to dextran. These difficulties may be minimized, we think, by ensuring that burnt cane is cut and transported to the mill without delay. This applies particularly to the latter part of the season. At this period of the season we presume that the higher temperatures make delay more significant in promoting enzyme action.

Soluble Phosphate in Raw Sugars

Soluble phosphates were considered to be components of raw sugar likely to alter filtrability, and numerous experiments have confirmed that soluble phosphates do affect filtrability markedly.

This result is particularly interesting when studied in conjunction with our work on the effect of starch. As stated earlier, many raw sugars containing starch in excess also contained phosphate in excess[10]. This is not put forward as being necessarily so but merely emphasizes the interesting point that one impurity bolsters the effect of another. If this interaction is not known and if the presence of one of the impurities is not known our thoughts regarding the particular impurity being studied are confused.

This always appears obvious and simple after we know, but great perplexity has occurred until we have discovered the co-occurrence and inter-action of two classes of impurity.

The presence of soluble phosphate in raw sugar is attributed to insufficent factory control of pH, which can be rectified by known means, as discussed subsequently.

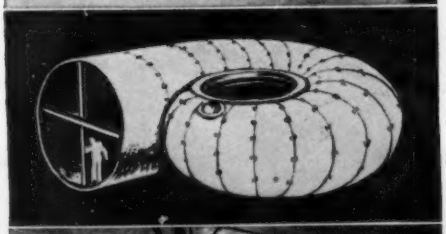
(to be continued)

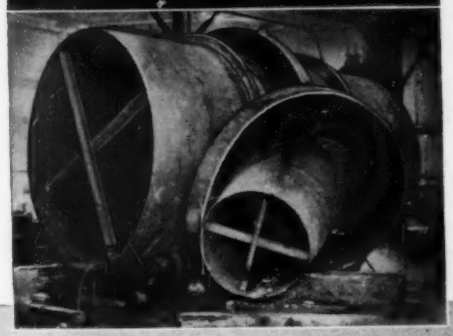
[9] Cortis-Jones: *Proc. 10th Congr. I.S.S.C.T.* 1959 (to be published).

[10] Nicholson: *Proc. 10th Congr. I.S.S.C.T.*, 1959 (to be published).

[11] Nicholson and Horsley: *I.S.J.*, 1958, **60**, 260.

[12] Nicholson and Lilienthal: *Aus. Biol. Sci.*, 1959, **12**, (2). (In press.)





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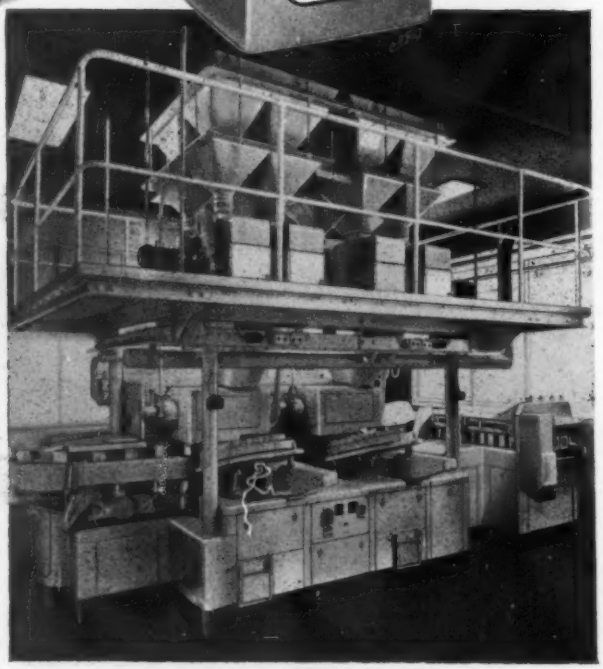

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Automatic Control of Mill Feeding. M. RIVIÈRE. *Rev. Agric. Sucr.* (Mauritius), 1958, **37**, 291–297.—Factors affecting regularity of mill feeding are discussed, and methods of achieving this described, with particular reference to the Mulgrave electronic control system[1]. It is recommended that two sets of knives be used, each with its own carrier. In the case of a single carrier, the cane thickness is measured as a function of the power required by the knife motor; when this exceeds a predetermined level, the drive is disconnected by means of a magnetic slip clutch. With separate carriers the first knife motor power varies with the fibre, but in the second depends on the cane blanket thickness and carrier speed, hence the thickness is measured by a feeler plate and the position of this controls the carrier speed. A system of this type is in use at Réunion factory.

* * *

Milling in Natal. A. VAN HENGEL. *Rev. Agric. Sucr.* (Mauritius), 1958, **37**, 321–326.—A comparison is drawn between 1957 milling data for South Africa and 1955 data for Mauritius; the latter are considered better. If the Natal moisture in bagasse could be reduced to the same figure as in Mauritius, reduced extraction would be increased from 94·8 to 95·4 with consequent returns. Methods of improving milling efficiency are discussed—these include feeding devices, among which the underslung roller is preferred, and correct mill settings. It is hoped that a survey throughout Natal will allow correlation of mill openings and results so that the optimal value of the former may be calculated.

* * *

Influence of Scaling on the Heat Transfer Coefficient of Juice Heaters. T. MAIGROT. *Rev. Agric. Sucr.*, 1958, **37**, 327–331.—Heat transfer rate was found to drop in one bank of juice heaters at Britannia Sugar Estate from 1270 Cal/sq.m./°C/hr on Monday to 742 on Saturday. It is recommended that a spare heater be kept, therefore, for cleaning to be possible while the factory keeps running. The thickness of scale deposited was measured as 0·0024 inches, so that its specific conductivity is 0·88 B.Th.U./sq. ft./°F/inch. Compilation of such records are useful in avoiding excessive "tolerances" in design of equipment, with consequent economies.

* * *

Gradual Expansion of a Milling Tandem. L. LINCOLN. *Rev. Agric. Sucr.* (Mauritius), 1958, **37**, 342–345.—Expansion at Médine factory from 50 to 120 t.c.h. over 11 years was carried out in three stages. In 1946, Médine had a set of cane knives, two 2-roller crushers and four smooth-roller mills. In 1948, the last two mills were replaced by three 34 × 66 inch mills. One crusher and one old mill were removed, and the capacity increased to 60 t.c.h. In 1950/52, the remaining crusher was replaced by a new three-roller crusher and a second set of knives while the gearing was altered, increasing capacity to 80 t.c.h. In 1953/57, the last two units were replaced with two 35 × 72 inch mills, and feed rollers and Edwards accumulators were fitted.

* * *

Adaptation of a Sugar Factory to Superheated Steam. F. ADAM. *Rev. Agric. Sucr.* (Mauritius), 1958, **37**, 346–347.—Excess superheated steam not required by the turbines may be utilized by reducing its pressure and adding water; alternatively it can be used to drive engines normally working with saturated steam. In this case, however, care has to be taken with lubrication, and it is noted that "compound" oils should not be used.

* * *

Quality of Boiler Feed Water. R. RAFFRAY. *Rev. Agric. Sucr.* (Mauritius), 1958, **37**, 351–355.—The 100 p.s.i.g. fire-tube boilers in Mauritius are gradually being replaced by high-pressure (250 p.s.i.g.) water-tube boilers, for which the feed water quality is of great importance. The qualities of good water are discussed and methods of feed treatment reviewed briefly.

* * *

Power Factor in Industry. R. HARDY. *Rev. Agric. Sucr.* (Mauritius), 1958, **37**, 356–363.—Alternating current passing through an appliance is partly used for producing work, and partly in the production of magnetic effects. The ratio of the first to the whole is called the power factor (p.f.) and it is obvious that the lower the p.f. the more current must be supplied to produce the same work. The main causes and effect of low p.f. are mentioned and two methods of correction are discussed; these are fitting of capacitors and use of synchronous motors. The relative merits of these are discussed.

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Silver Continuous Diffuser in Hawaii. ANON. *Sugar y Azúcar*, 1959, **54**, (3), 29.—See *I.S.J.*, 1959, **61**, 63, 142.

* * *

Automatic Centrifugals in Sweden. H. LUNDBERGH. *Sugar y Azúcar*, 1959, **54**, (3), 29.—Two types of centrifugal—for high-grade and low-grade massecuites—have been developed by the Swedish Sugar Corporation in collaboration with A.S.E.A. and AB. Landsverk. The first is an automatic batch machine with Ward-Leonard drive, and regenerative and electromagnetic braking, automatic run-off and wash

[1] *I.S.J.*, 1956, **58**, 278.

separation, and a maximum speed of 1200 r.p.m., producing 1100 *g*. The low-grade machine has manual or pneumatic discharging and a direct-connected induction motor instead of the Ward-Leonard drive. It has a maximum speed of 1500 r.p.m., producing 1500 *g*.

* * *

Research on Sugar Refining. XVI. Study on the Structure of $ZnCl_2$ Activated Carbon. M. KOMOTO, S. NAGASAWA and K. TANIGUCHI. *Sci. Rpts. Hyogo Univ. Agric., Ser. Agric. Chem.*, 1957, **3**, 27–32; through *S.I.A.*, 1959, **21**, Abs. 87.—Activated carbon was prepared from sawdust at 150° to 1000°C, with steam activation and $ZnCl_2$ activation, and the properties of the products were compared by measuring the adsorption of $KMnO_4$ and by other means. Graphitization takes place at higher temperatures, as shown by the electrical resistance. X-ray diffraction showed that crystalline structures developed slightly above 500°C. $KMnO_4$ was partly reduced on adsorption, depending on contact time, and the reduction was greater after lower activation temperatures. The pH of the carbon increased with increase in activation temperature.

* * *

Research on Sugar Refining. XVII. Activation of Pine Coal by the Steam Method. H. KOZIMA and T. SIMIZU. *Sci. Rpts. Hyogo Univ. Agric., Ser. Agric. Chem.*, 1957, **3**, 37–39; through *S.I.A.*, 1959, **21**, Abs. 88.—Activated carbon prepared from pine coal was tested for the decolorization of raw sugar solutions. Carbon steamed at 600°C had no decolorizing power, and best results were obtained by steaming at 800°C for 60 min, or at 900°C for 20 min.

* * *

Instrumentation and Process Control in the Sugar Factory. E. R. DE LUZURIAGA. *Proc. Philippines Sugar Tech. Conv.*, 1956, 20–31.—Instrumentation of mills, boilers, switch gear, heaters, evaporators, vacuum pans and centrifugals is surveyed, with particular reference to equipment installed at Victorias Milling Co.

* * *

Recent Factory Improvements at Victorias Milling Company's Factory. W. A. BUDDINGH. *Proc. Philippines Sugar Tech. Conv.*, 1956, 46–52.—Equipment installed during the 1954/55 and 1955/56 crops include 12 low-grade high-speed water-driven Western States centrifugals, a 20-ft Dorr clarifier, a quadruple effect evaporator with a pre-evaporator, using 3-stage juice heating; forced and induced draught fans in the boiler house, and a complete boiler feed-water treatment plant.

* * *

Aids to Increase Mill Capacity and Efficiency. D. G. SEMPLE. *Proc. Philippines Sugar Tech. Conv.*, 1956, 53–55.—It is recommended that attention be paid to cane preparation, turn-plate settings, grooving, feeder rolls, deflector plates and tongues in Ewart-type intermediate carriers, top roller bearing lubrication and maceration temperature control.

Removing Mill Pinions. H. V. RODRIGUEZ. *Proc. Philippines Sugar Tech. Conv.*, 1956, 56–57.—A description is given of a hydraulic toggle-lever device whereby a thrust of 400 tons may be developed between the end of the roller and the pinion face; this is considered adequate to free any obstinate pinion which cannot be easily removed.

* * *

Method of Welding the Mill Reduction Gear. P. G. GATILAO. *Proc. Philippines Sugar Tech. Conv.*, 1956, 58–63—Details are given of the technique employed in welding a cracked gear, and fitting of reinforcing plates on either side of the gear.

* * *

Use of Wooden Save-All to Control Entrainment. J. S. DALHBERG. *Proc. Philippines Sugar Tech. Conv.*, 1956, 64–66.—A Stillman tube and plate entrainment separator was replaced with a wooden maze unit constructed of $1\frac{3}{4} \times 2\frac{3}{4}$ in timbers toe-nailed to each other and held in a mild steel hoop. The unit is 80–90% cheaper than a metal unit, requires no foreign exchange, has a useful life of 5–8 years, has a greater holding efficiency for entrained particles, and does not collect scale, so that cleaning is obviated.

* * *

Recent Developments in Sugar Engineering and Observations from Indian Sugar Factories. J. O. SAGON. *Proc. Philippines Sugar Tech. Conv.*, 1956, 67–64.—Various items of Indian equipment and practice are described and contrasted with the Philippines.

* * *

Water Meters on Boiler Performance. H. RODRIGUEZ. *Proc. Philippines Sugar Tech. Conv.*, 1956, 81–84.—A water meter was used to compare evaporation of the boilers at La Carlota, and details of the observations are presented.

* * *

Maintenance of Fuel Injection Equipment in the Sugar Central. R. J. PALISOC. *Proc. Philippines Sugar Tech. Conv.*, 1956, 85–88.—Apparatus and methods for testing the fuel injection of diesel engines are described.

* * *

Use of Temporary Protective Corrosion Prevention in Sugar Centrals. H. J. UNSON. *Proc. Philippines Sugar Tech. Conv.*, 1956, 89–96.—The theory of corrosion prevention is briefly discussed and the types of temporary protection surveyed, with an appendix of applications for each.

* * *

A Brief Review of the Philippine Sugar Factory Performances during the Last Five Years. J. P. STO. DOMINGO. *Proc. Philippines Sugar Tech. Conv.*, 1956, 239–242.

* * *

Manufacturing Techniques and Quality of Raw Sugar for Bulk Handling. A. R. DE LUZURIAGA. *Proc. Philippines Sugar Tech. Conv.*, 1956, 275–276.—Sugar for bulk handling should be of high polarization

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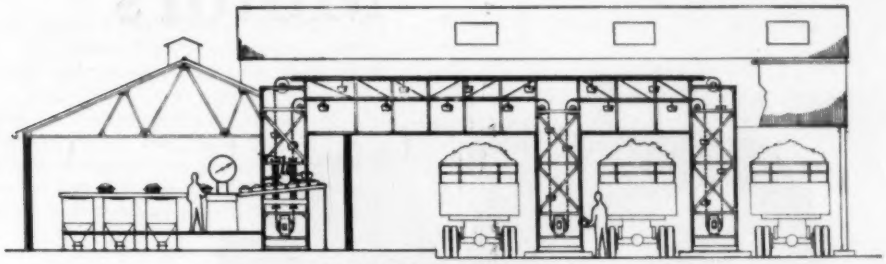

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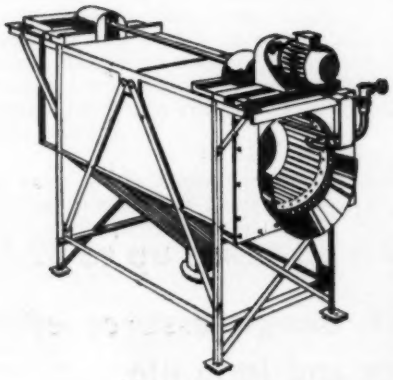

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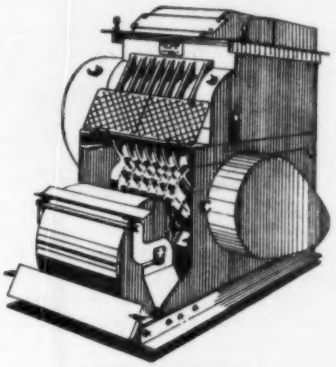

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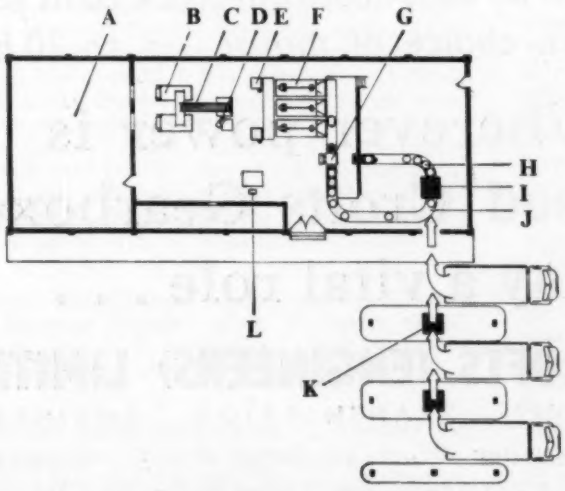

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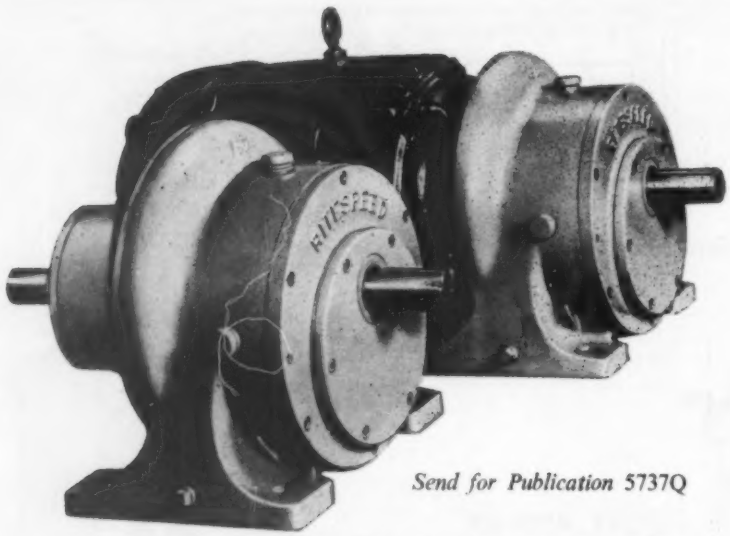

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* * *

Reaction of Low Fibre Cane towards Milling. D. SUERTE. *Proc. Philippines Sugar Tech. Conv.*, 1956, 277–283.—Sucrose extraction from low fibre cane such as Alunan and POJ 3016 is lower than would be expected; this is attributed to the nature of the cells, the brittle nature of the canes which makes them break up more readily to a powdery absorbent bagasse; and to the fact that the damp powdery mass assumes plasticity and so offers less resistance to the rollers.

* * *

Effect of Burnt Cane on Sugar Recovery of Pasumil. F. V. DEOMANO. *Proc. Philippines Sugar Tech. Conv.*, 1956, 289–294.—The proportion of burnt cane has increased from 5% pre-war to almost 50%. This is deprecated since the burnt cane gives lower juice purities than unburnt cane, adversely affecting the sugar recovery. It is calculated that 69,494 extra piculs (4330 long tons) of sugar would have been produced at Pampanga Sugar Mills if, during the two crops 1954/55 and 1955/56, the cane crushed had all been unburnt.

* * *

A Study of the Sugar Factory Performances of the Philippines and Other Countries. J. P. STO. DOMINGO. *Proc. Philippines Sugar Tech. Conv.*, 1956, 303–318.—Performance data for a number of countries are tabulated and compared with those of the Philippines. Local conditions affect the data considerably, but generally the Philippine factories produce more sugar and have a higher grinding rate, have a low milling extraction, and high boiling house recovery, and crush cane of comparatively poor quality.

* * *

The Reduced Boiling House Recovery, E.S.G. M. V. LOCSIN. *Proc. Philippines Sugar Tech. Conv.*, 1956, 319–324.—The development of DEERR's reduced boiling house recovery, E.S.G., concept is described, as well as the Gundu Rao proposal and the views on these expressed in the "System of Cane Sugar Factory Control" of the I.S.S.C.T. The two values, calculated for 1955/56 data from the Philippine factories, are compared; in most cases there is very little difference, but where juice purity is low, the order of the factories is varied to some extent.

* * *

Philippine Sugar Centrals' Cane Weighers and Crusher Juice Sampling Systems. C. B. RAYMOND, M. R. CAGUICOA and E. P. VILLAREAL. *Proc. Philippines Sugar Tech. Conv.*, 1956, 343–361.—A survey.

* * *

Milling Test and its Interpretation. T. VENTURA and D. SUERTO. *Proc. Philippine Sugar Tech. Conv.*, 1956, 363–366.—Materials and procedure are described for sampling of juice and bagasse from each set of rollers in a mill train and the calculations of the performance of the mills.

Correct Lubrication. M. T. FELICIANO. *Proc. Philippine Sugar Tech. Conv.*, 1957, 79–83.—The selection of the right lubricant for an application is based on a number of factors, and two of the major ones—operating temperature and operating pressure—are discussed.

* * *

The Use of "Epicote" Resins in Industrial Painting and Structural Protection. A. R. VALENZUELA. *Proc. Philippines Sugar Tech. Conv.*, 1957, 84–85.—Applications of the "Epicote" epoxy resin paints are briefly reviewed.

* * *

Transformer Oil Maintenance. L. G. PADLAN. *Proc. Philippines Sugar Tech. Conv.*, 1957, 86–90.—Sampling and testing of transformer oil is described. It is recommended that this should be a regular practice as part of routine preventive maintenance.

* * *

An Introduction to the Werkspoor Rapid Crystallizer. J. M. ARELLANO. *Proc. Philippines Sugar Tech. Conv.*, 1957, 91–96.—The construction and operation of the Werkspoor crystallizer are described and illustrated.

* * *

A Simple Juice Measuring Tank for Clarifiers. W. B. PAÑGAN. *Proc. Philippines Sugar Tech. Conv.*, 1957, 97–103.—Hot limed juice is fed into one side of a small tank which is split into half by a baffle. On the other side, cross partitions form three chambers from each of which leads a pipe to one of three clarifiers used. In the baffle are cut three holes the width of which are in proportion to calculated volumes of the appropriate clarifiers, so ensuring that the volume of juice supplied is in proportion to the relative volumes. Sliding weirs, supported by threaded shafts, close each or all of the holes if and when necessary.

* * *

Refining Qualities of some Philippine Sugars. T. VENTURA. *Proc. Philippines Sugar Tech. Conv.*, 1957, 121–126.—Details of pol, "flowability" (free-flowing nature or otherwise); filtrability, colour and grain size of raws from 11 Philippine suppliers to a local refinery are tabulated and comparative data for Hawaiian sugar refined at C. & H., Crockett, are also given.

* * *

Technological Improvements that pull Biscom abreast of the Philippines Top Mills. G. G. GUILLEU. *Proc. Philippines Sugar Tech. Conv.*, 1957, 174–182.—Binalbagan-Isabela Sugar Co. Inc. is a post-war amalgamation of five milling companies, and its initial equipment was assembled from the war-damaged Binalbagan and Isabela mills. To handle the cane it was decided to install two turbine-driven Gruendler shredders, one each between the knives and mills of the two tandems; these have been found to increase capacity and extraction, while requiring no maintenance during crushing of a 500,000 ton crop. Removal of 60–90% of the mud covering canes, after flooding due to typhoons, has been

achieved by using a 1200-gallon pump feeding water to a washer over the cane carrier. Steam capacity of boilers has been raised by fitting ducts and fans to direct air to the central bagasse pile, improving its efficiency of combustion. Other equipment added includes a juice heater, three continuous settling tanks, a quadruple effect evaporator, a calandria pan, Dyer-Blanchard cooling coils for crystallizers, high-speed centrifugals, pumps of increased capacity, a new evaporator body; a number of capacitors to increase the power factor and generator performance, and extensions of rail track and loading switches. Later improvements include removal of juice groove scrapers and bar assembly under the feed roller, a new type of juice grooving; a bagasse conveying and storage system, and alterations to the liming system.

* * *

Value of a Lubrication Survey. F. NARCISO. *Proc. Philippines Sugar Tech. Conv.*, 1957, 183–186.—Where a large number of lubricants is specified by makers of diverse machinery in the factory, it is recommended that a survey of the equipment and its lubricant needs be made so as to determine if it is possible to decrease the number of grades and also the rate of consumption of the lubricants.

* * *

Lubrication, its Importance in Preventive Maintenance. P. C. VALENZUELA. *Proc. Philippines Sugar Tech. Conv.*, 1957, 187–192.—The importance of correct lubrication is discussed and the establishment of a routine lubrication programme recommended.

* * *

Treatment of Filtrate from Vacuum Filters. F. V. DEOMANO. *Proc. Philippines Sugar Tech. Conv.*, 1957, 209–213.—Recirculation of impurities has been prevented, and a light-coloured clear juice obtained by liming muddy filtrate after addition of clarifier muds, followed by settling in a separate clarifier.

* * *

A Common Sugar Distribution Table as a Basis for Measuring Factory Performance. J. P. STO. DOMINGO. *Proc. Philippines Sugar Tech. Conv.*, 1957, 214–230.—The distribution factor used when calculating cane payment is the ratio of actual to theoretical sugar yield, and is based on first expressed juice analysis and Java Ratio, sugar and molasses purities. The use of the factor as a means of comparison of the performance of Philippine factories is discussed.

* * *

New Flocculating Agents to Improve Clarification. M. M. MORON and A. G. KELLER. *Sugar J.* (La.), 1959, **22**, (10), 27–31.—After laboratory tests on a number of flocculating agents, one of these, "Separan AP-30", was tested in factory trials. Flocculation was improved, settling rates increased, and volume decreased, and the mud was more readily thickened. The muds filtered well and the pol % filter cake and pol loss % cane, were reduced substantially. The sugars produced seem to have a higher filtration rate than those produced when using lime defecation.

Extra Fuel Problem in the Deccan Sugar Factories. R. RAGBIR and K. R. SANYASIRAJU. *Indian Sugar*, 1959, **8**, 663–665.—Two systems of vapour bleeding for juice heating and pans are described and briefly discussed.

* * *

A New Approach to Sugar Cane Milling. M. A. SUÁREZ CARREÑO. *Sugar y Azúcar*, 1959, **54**, (4), 32–33, 45.—Milling is considered from two aspects: the process and the mill. The former is again considered in terms of the initial mechanical separation of raw juice by the crusher and first mill, and the combined mechanical and solvent extraction in subsequent mills. The criterion proposed for the first is that of a fibre concentration raised to 40% from e.g. the initial 14% (corresponding to a juice extraction of 80%). Cane mat thickness may be up to 4 lb/sq. ft. for a roll speed of 30 f.p.m. without impairing efficiency. The quantity of maceration used should be four times that of raw juice remaining in bagasse; of this 20% on cane should be water and the remainder recirculated juices. A formula is presented for determination of maceration efficiency; in practice it usually is 40–60%. In discussing the mill, reference is made to the change of direction of flow of juice[1], and the effect of a number of variables—speed, compaction, and juice : fibre ratio—on mill efficiency is discussed.

* * *

Method of obtaining Stronger Pressed Refined Sugar. I. F. ZELIKMAN. *Sakhar. Prom.*, 1959, (3), 6–8.—Automatic production of pressed cubes in which each is pressed separately in a rotary press, dried and packed, is rapid and requires little floor space. However the cubes are not as strong as those produced by the usual (Höweler) process. To satisfy demands for stronger, slow-dissolving cubes, it is recommended that the cubes be pressed out of moister sugar and subjected to a three-stage drying process[2].

* * *

Progressive Technology of Refined Sugar Production. M. B. YARMOLINSKII. *Sakhar Prom.*, 1959, (3), 8–10. The question of combining production of refined sugar and confectionery has been studied experimentally, the latter being obtained from sugar and active carbon-treated molasses.

* * *

Trends in the Development of Centrifugal Design for Sugar Massecuite Centrifugalling. B. N. TERESHIN. *Sakhar Prom.*, 1959, (3), 10–14.—Modern trends in centrifugals design are discussed with particular reference to high-speed, continuous and automatic machines, automatic charging and discharging, ventilation, braking and power requirements.

* * *

Addition of Cobalt and Manganese Salts in the Evaporation of Cane Sugar Syrups. K. SUZUKI. *J. Chem. Soc. Japan, Ind. Chem. Sect.*, 1958, **61**, 56–58; through *S.I.A.*, 1959, **21**, Abs. 201.—The effect of

[1] *I.S.J.*, 1959, **61**, 241.
[2] See *I.S.J.*, 1958, **60**, 141.

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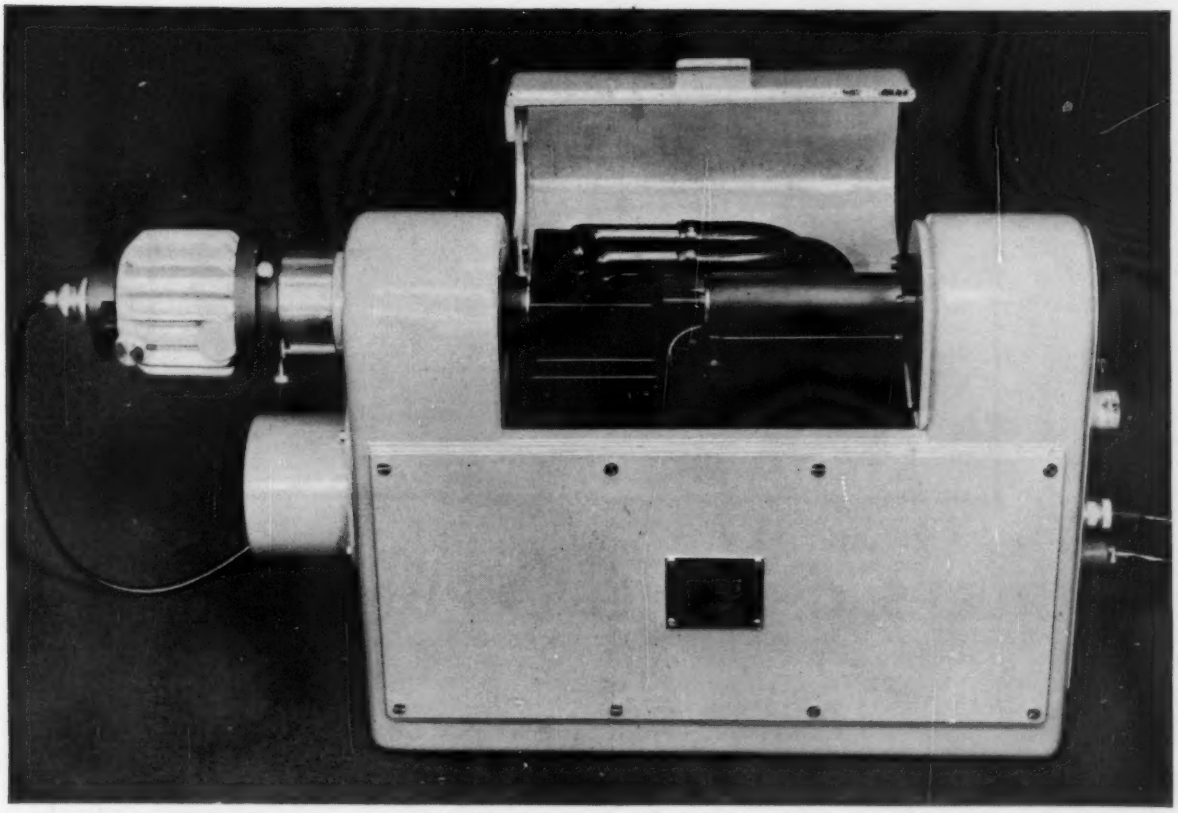

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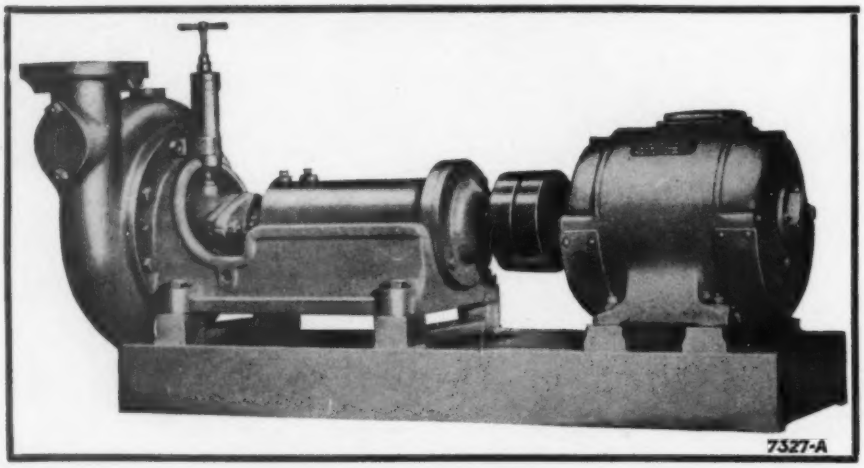

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Co and Mn salts on sugar boiling was studied in a test vacuum pan (*cf. J. Soc. Chem. Ind. Japan*, 1943, **46**, 34). Syrups were prepared from sugar containing 0·06% of water, 99·86% of sucrose, 0·04% of reducing sugars and 0·011% of ash. The syrups contained 2400 g of sugar, 2000 g of water, and 0·8 g of seed sugar, 2·25 mg each of $CoSO_4$ and of $MnSO_4$; the syrups were boiled at 58·74°C or 46·18°C, yielded 1370 and 1460 g of condensed water after 143 min or 82 min boiling time, and produced 58% of crystalled sugar, on massecuite. Boilings were also made without Co and Mn salts; without the salts the product was brownish-yellow, but with them the sugar was white and the molasses only slightly coloured. The use of 0·1 p.p.m. of Mn and Co salts gave only slightly less successful results. In tests with low-grade syrups there was vigorous foaming on reduction of the pressure, but this was much decreased in the presence of Co and Mn salts, and the time of boiling and power requirement were also decreased.

* * *

Performance of Milling Trains; Some Thoughts on Imbibition. K. DOUWES DEKKER. *S. African Sugar J.*, 1959, **43**, 327–335.—Using as a basis a "standard" cane of fixed fibre and sucrose content, and assuming an undiluted juice of uniform Brix, the minimum extraction is calculated for bagasse of varying fibre content. Increases above this, for a constant fibre in bagasse, must be due to imbibition. The maximum extraction is then calculated for 12-, 15- and 18-roller tandems assuming imbibition of 200% on fibre and complete mixing of the water or returned juice with the juice in bagasse. The difference between these figures indicates the great effect of the efficiency of mixing of imbibition; with 100% efficiency, extraction with a 12-roller tandem would be greater than at present achieved with 15-, 18- or even 21-roller tandems in Natal. A system is developed for calculation of the efficiencies of imbibition and an example of its use given in calculations to indicate whether production of drier bagasse or better mixing gives higher extraction.

* * *

Modernization of the Lula Factory. C. SAVOIE. *Sugar J.* (La.), 1959, **22**, (11), 11–14.—Reconstruction of Lula factory, Louisiana, since 1937 is described. Annual capacity has increased from 40,000 tons of cane to 100,000 tons.

* * *

Improved Cane Mud Filtration with the Eimco "Rotobelt" Filter. E. R. VRABLIK and D. A. DAHLSTROM. *Sugar J.* (La.), 1959, **22**, (11), 32–43, 47.—The design of the Eimco "Rotobelt" filter, an endless belt vacuum drum filter with cake discharge by passing over a small diameter pulley, is described. Pilot plant tests using a 12 × 18 in drum have been carried out on clarifier muds in a cane sugar factory and have been successful, giving high filtration rates and a clear filtrate, which could be sent direct to the evaporator. Further details are given of a full-scale filter operating on first carbonatation juice in a beet sugar factory. Advantages include high clarities, low sucrose inversion and great flexibility.

* * *

Some Notes on Pan Design and a New Arrangement of (the) Calandria. C. J. ALLAN and A. P. SARANIN. *Proc. 26th Conf. Queensland Soc. Sugar Cane Tech.*, 1959, 35–44.—The rate of crystallization of sucrose in a pan is discussed; while under perfect conditions it is a maximum at the upper limit of the metastable zone, it is not possible to keep this supersaturation constant throughout the massecuite, and consequently the rate of crystallization is less than this maximum. This is expressed as the crystallization rate ratio = actual rate/maximum rate × 100%, and will depend, among other things, on pan design and grade of massecuite. The mechanics of crystallization are discussed, together with the requirements in pan design which they imply. A duplex calandria pan is described with separate steam entries for each half, so that the circulation can be affected by variation of the pressure in both halves. Details and advantages are discussed.

* * *

Chemical Removal of Evaporator Scale. Laboratory and Factory Experiments. E. T. RELF and D. H. FOSTER. *Proc. 26th Conf Queensland Soc. Sugar Cane Tech.*, 1959, 51–56.—Scaled tube sections were submitted to the action of EDTA, hydrochloric acid and sulphuric acid solutions, the last two in some cases with molasses present as corrosion inhibitors. The first two were found to be effective, but since the HCl appeared to be more economical, it alone was used in factory trials. It was found that the acid (containing molasses) would remove scale satisfactorily at first, but after four weeks scale remained, which was not removed. Spraying first with caustic soda enabled the acid to remove this scale and silica remaining was found to be easily removed by light brushing. In corrosion tests, the acid was found to attack mild steel to the extent of a loss of 0·005 inches for immersion over 25 weeks or 0·001 inches for acid spraying. Corresponding attack on brass was 0·003 inches; these figures would be reduced in practice because of the protection afforded by the scale.

* * *

Notes on the Dirty Top Roller. W. R. CRAWFORD. *Proc. 26th Conf. Queensland Soc. Sugar Tech.*, 1959, 57–61.—In some Australian mills the scraper plate for the top roller is lifted and bagasse allowed to compact itself in the roller grooving and even project beyond the periphery of the grooves. This is claimed to increase juice extraction and better mill feeding. This was investigated and confirmed with the S.R.I. experimental 3-roller mill; reasons are suggested for the effects noted. It is observed that the dirty top roller floats more readily, but also that its grooves wear faster—from 35° to 50° or more in a season. However, provided wear is not excessive the dirty top roller can be advocated.

The Effect of Diffusion Temperature on the Filtrability of Purified Juices. K. D. ZHURA. *Sakhar. Prom.*, 1959, (2), 27–30.—The relationship between peptization of the beet pectins, diffusion temperature and time has been studied, so as to determine the effect of increased maximum diffusion temperature on the quality of the juices and their filtrability after purification. The optimal mean diffusion temperature was also determined by comparing the filtration coefficients determined by a method previously described[1]. When beets were heated for 60 and 120 min at a temperature within the range 70–90°C the pentosans (determined by bromine test) were found to increase at a constant rate over the range 70–85°C, and then to increase sharply from 85 to 90°C. Filtration at 80°C and 1 atm of juice limed with 2% CaO at 85°C showed that the optimal mean diffusion temperature is 65–72°C. Increase to 75–77°C caused a drop in the filtration rate (although at 80°C there was an unexpected increase) indicating a large accumulation of pectins in the juice. When processing healthy beet, the mean temperature may be 70–72°C, but should be constant so as to maintain a filtration coefficient of at least 4–5. With return of 100% carbonatation juice, filtration is improved by 45–60% (sometimes 80%), but only at a diffusion mean temperature of 70–72°C, above which it worsens. An increase of lime from 2 to 3% is recommended to improve filtration.

* * *

Beet Unloader-Piler PM 3-4. I. A. KLIMOV. *Sakhar. Prom.*, 1959, (2), 36–37.—A detailed description is given of the Soviet PM 3-4 beet unloader-piler, which can unload about 70–80 tons of beet per hr depending on the type of vehicle.

* * *

Operation of the PM 3-4 Beet Unloader-Piler. I. L. VILYANSKII. *Sakhar. Prom.*, 1959, (2), 38–40.—Further details are given of the machine, now in mass production, which is said to have many advantages over comparable machines.

* * *

Factors Affecting Evaporation and Heat Economy of a Sugar Factory. F. BONACKER. *Zeitsch. Zuckerind.*, 1959, **84**, 129–135.—Factors having the greatest effect on performance of the evaporators and on the heat economy of a beet factory are discussed with 21 references to the literature. Advice is offered on methods of improving the heat economy and maintaining optimal conditions in the evaporator station.

* * *

Effects of Beet Harvest Mechanization. C. HELLER. *Zeitsch. Zuckerind.*, 1959, **84**, 138–140.—Mechanical beet harvesting is of great benefit during a wet summer, when the actual gathering can be done only on solitary fine days. The harvesting period can be shortened to 4–6 weeks, as opposed to a processing campaign of 10–14 weeks. However, as a result the beet must be stored for 4–8 weeks or more. Small piles cost little but have relatively large surfaces, and are susceptible to frost. It has been found that in a field stack losses over 30 days may be 147 g sugar/ton beet. Ventilation of the piles is discussed. The increased amount of dirt on mechanically harvested beet must be removed and the installation of the necessary equipment at unloading points and storage sites is recommended.

* * *

Electrical Interrupters in the Sugar Industry. G. SALANI. *Ind. Sacc. Ital.*, 1959, **52**, 1–6.—The electrification of sugar factories is discussed, with the modern tendency to have separate motors driven by power supplied from a central generator. Each motor requires a control switch and cut out, and the various types are surveyed and their maintenance and standardization discussed.

* * *

Decolorization of Sugar Juices by means of Decolorizing Resins. S. FUMASONI, E. MARIANI and G. C. MAURA. *Ind. Sacc. Ital.*, 1959, **52**, 7–13.—Comparative tests have been carried out on the decolorization of thick juice, remelt syrup, and refinery syrup using these resins ("Asmit 259", "Asmit 224" and "Amberlite IRA 401 S") as well as an activated carbon ("Antichromos 26"). The sugar solutions and decolorizers were brought separately to thermal equilibrium in a thermostatic bath at 80°C, and mixed. The equilibrium colour was then measured for several wavelengths and the results drawn in the form of graphs. The action of the resins and carbon are found to follow a Freundlich-type equation and values of the exponential function are tabulated for each.

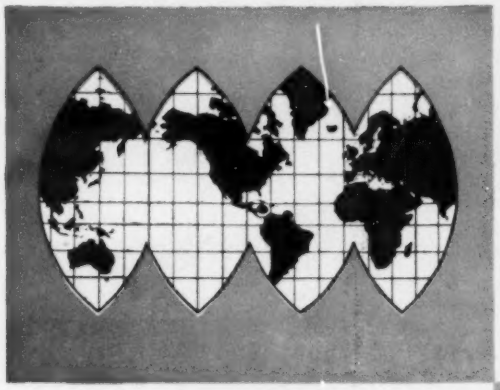
* * *

Use of Exchanger and Declorizing Resins in the Sugar Industry. E. MARIANI. *Ind. Sacc. Ital.*, 1959, 52, 14–24.—The development of the use of ion exchange resins in the sugar industry during recent years is reviewed, together with their exchange capacities and the effect of temperature on their use for reducing calcium content or colour of sugar liquors.

* * *

Tests with Maleic Hydrazide 1952–57. M. DRACHOVSKÁ *et al. Listy Cukr.*, 1959, **75**, 49–54.—The literature on maleic hydrazide spraying of beet before harvesting and in storage is reviewed with 27 refer-

[1] *I.S.J.*, 1959, **61**, 26.



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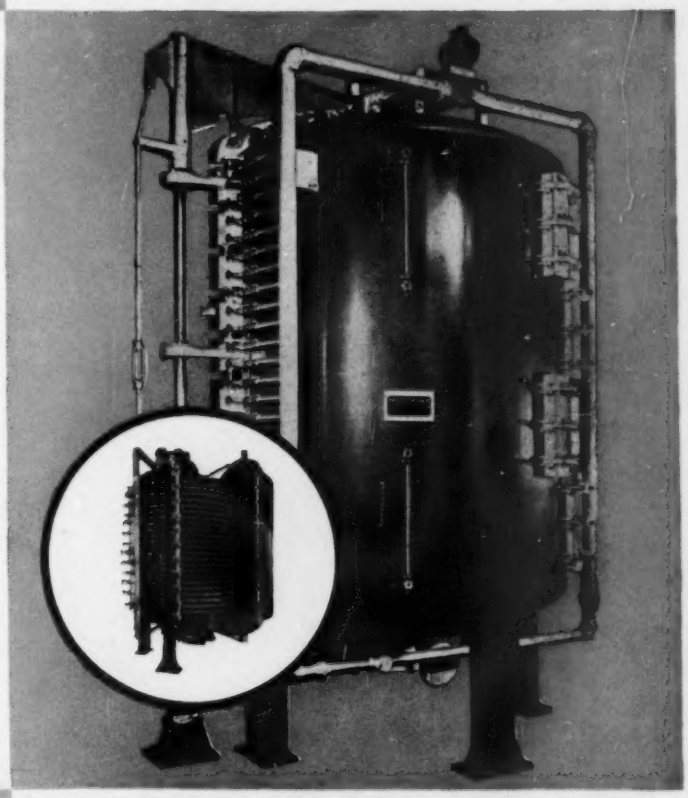

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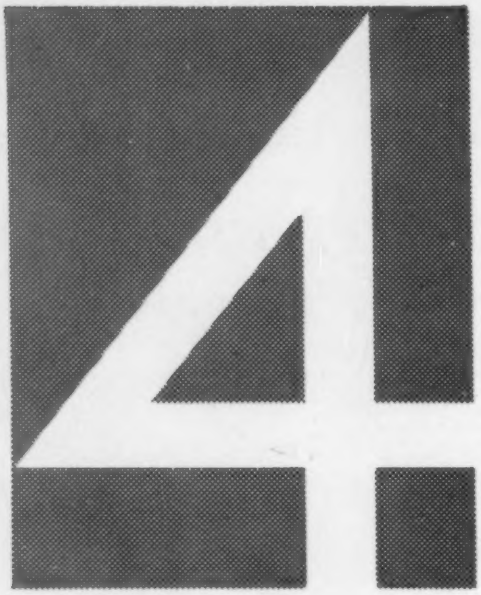

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ences. Full details are given of 37 trials in Czechoslovakia, although the results of individual tests have not been checked mathematically. It is concluded that maleic hydrazide is only to be recommended where there is a danger of sugar loss after rain, through further growth, or where the beet has been stored in warm and damp weather, when there is danger of sprouting.

* * *

Nomogram for Simple Determination of Standard Molasses Purity according to P. M. Silin. A. SEPITKA. *Listy Cukr.*, 1959, **75**, 59-61.—A nomogram is given for the determination of "standard" molasses purity (i.e. purity of saturated molasses at 82°Bx with direct refractometry and at 83·5°Bx with 1:1 dilution, both at 40°C). The nomogram permits calculation of the amount of water to be added to or evaporated from the molasses to give the Brix required for P. M. SILIN's crystallization test (adding 20% seed sugar to sample, maintaining at 40°C for 3 days and filtering). From the nomogram the Brix and pol of the mother-liquor are converted to the purity, and from this the "standard" molasses purity. The accuracy of the nomogram is within the limits of error for the method and sample calculations are given as illustration.

* * *

Deionization of Sugar Juices by Electrodialysis using Ion Exchange Membranes. (I) and (II). J. BURIÁNEK and D. SLECHTOVÁ. *Listy Cukr.*, 1959, **75**, 62–69.—The theories of electric membrane demineralization of sugar juices are explained. Graphs are drawn showing the dependence of the electric current intensity on time of treatment of thin juice, green syrup and molasses. The question of the most suitable intermediate product to treat with permselective membranes for the production of yellow sugar was studied. From the technological viewpoint and considering the electrical requirements and surface area of the membranes, a mixture of green syrup and 2nd carbonatation juice, mixed to a predetermined maximum concentration, would be most suitable. This would provide for return of green syrup and would considerably reduce the number of final product boilings. Graphs are drawn showing the relationship between the current intensity and time for a 30 and 40°Bx solution, and between the ionization charge and time. A graph is also drawn showing the current required for various "degrees of deionization of solutions of different Brix. Tabulated data also act as a guide to determination of the optimal sugar content of the mixture.

* * *

Technical Progress in the (Polish) Sugar Industry. S. NIKIEL. *Preglad Tech.*, 1959, **80**, (12), 10–12.—As it is not considered economical to extend the Polish campaign beyond 20th December, increases in sugar production must be brought about by extending the existing factories and building new ones with a daily capacity of 3000 tons. The new equipment required by 1965 includes 55 continuous diffusers (DdS, Olier, and BMA), to be installed in 40 factories, and Szarejko filters for 20 factories (jute and cotton cloths will be gradually replaced by synthetic cloths). Hydrocyclones will gradually replace 2nd carbonatation juice filters, the $CaCO_3$ suspension being returned to progressive defecation. These will also be used for sand removal from milk-of-lime. In 20 factories cation exchange resins will be used for juice de-liming. Synthetic resins will be used in 7 factories for decolorizing affined 2nd and 3rd yellow sugar, thus increasing the amount of raffinade from 17,000 tons in 1958 to 70,000 tons in 1965. Also planned is the installation of 150 white sugar centrifugals and 130 sack-filling machines. Automatic control of 1st and 2nd carbonatation and evaporation is to be provided for. Provision is made for a capital investment of 3,100 million zloty (about £280 million).

* * *

Development of Micro-Organisms in Raw Juice. F. SCHNEIDER and H. P. HOFFMANN-WALBECK. *Zucker*, 1959, **12**, 142–147.—The relationship between bacterial growth and the difference between soil and raw juice temperature was studied by maintaining samples of soil from a beet field at 4 and 27°C and suspending 1% (on volume of juice) in sterilized raw juice samples before incubation at 27°, 40°, 55° and 65°C. The bacterial counts were determined by means of the Koch plate method and recorded in graphs. Two series of tests were made, with and without agitation (in the second case the juice was not sterilized but had low bacterial content). It was found that the greater the difference between soil and juice temperature the greater the lapse of time until the bacteria start to multiply again. The worst infection was found at 40°C, the majority of the bacteria being mesophiles. At 55°C the number of thermophiles had increased and by 65°C the total bacterial population was very small. It was found that the bacteria increased more rapidly in agitated juice. In further tests cossettes were infected with 1% bacteria on juice and heated to 40°C for 24 hr before adding to sterile raw juice. A marked increase in bacteria on addition to juice is clearly visible for the tabulated figures. Figures are also given for juice prelimed at 45°C at various pH values. The most dangerous source of infection are the walls, stagnating residual juice and bacterial deposits (slime) in the raw juice. A heat exchange between cossettes and raw juice, which leads to cooling of the juice, is especially dangerous when the temperature greatly exceeds 65°C, although if the temperature is lowered it must be raised to about 65°C at least after the juice extraction plant in order to prevent a greater increase in juice infection.

* * *

News on Sugar Storage. E. SZEGO. *Ind. Alim. Agric.*, 1959, **76**, 101–103.—The development of bulk storage of sugar in silos is reviewed, and particular reference made to the SSA-Weibull silo erected at Malmö, Sweden, in 1957 for storage of raw sugar received in cargoes of 10,000 tons and more.

Problem of Electricity in the Sugar Factory. Improvement of Cos ϕ by use of a Synchronous Compensator Alternator. J. BLANC. *Ind. Alim. Agric.*, 1959, **76**, 109–110.—It is possible to improve the power factor of alternating current electric motors by the use of condensers and synchronous compensators. The two are briefly compared, with preference for the second, and their use illustrated by calculations.

* * *

Large-Scale Separation of Fluids from Fibrous Pulps. N. W. PIRIE. *J. Biochem. & Microbiol. Tech. Eng.*, 1959, 1, (1), 13–25.—Most of the free fluid can generally be expressed from fibrous leaf pulps in a few seconds at 50 p.s.i. if the layer is kept thinner than 1 inch after it has been pressed, and if the fluid is allowed to run away freely. The need for this time and the frictional properties of many pulps are serious obstacles to the design of any strictly continous press. Roller presses do not allow enough time, screw expellers created too much friction, continuous centrifuges and some other arrangements are intricate and vunerable. An intermittent but automatic press, developed at Rothamsted Experimental Station, which avoides these defects, is described. In this, the material on a perforated conveyor is pressed by a ram and then moved forward as the ram lifts. One such machine has been made and produced leaf fibre of 65–70% water, which was more satisfactory than with any other type of press used. An outline is given of the principles on which an improved design will depend.

* * *

Nomogram for the Rapid Calculation of the Specific Heat of Sugar Juices. J. HUBERLANT. *Sucr. Belge*, 1959, **78**, 326–328.—A nomogram is presented based on the formula of CAMPBELL MACDONALD and RODGERS[1], relating the specific heat of the sugar solution to that of water, Brix, temperature and purity.

* * *

The De Smet Diffuser. A. PERNET. *Sucr. Franç.*, 1959, **100**, 94–98.—The De Smet beet diffuser is described in detail and illustrated. It comprises a perforated band on which travels a layer of cossettes of appropriate depth. Below the band is a series of chambers formed by partitions; these lead to slow-speed pumps which deliver to a spray over the cossettes above the previous chamber. Hot water is sprayed at the discharge end of the band and diffusion juice is collected from the chamber at the other. Thus the cossettes travel in counter current to juice of increasing sugar content. The cossettes are preheated with hot diffusion juice and loaded rollers press down on the cossette blanket over the last few chambers, so expressing more juice; the pulp discharged contains 8% solids. The belt is washed with a water spray after the pulp is discharged; the mixture of water and pulp is pumped to the blanket two chambers from the end. The temperature of diffusion is 75–78°C and the system lends itself readily to automatic control. The pulp is in very good condition since it is at rest on the band during diffusion, and this and the use of a rapid spray gives a very pure juice.

The Value of the Saturation Coefficient. I. N. KAGANOV and L. S. TVERDOKHLEBOV. *Sakhar. Prom.*, 1959, (3), 15–16.—The relationship between saturation coefficient and non-sugar concentration is illustrated by means of a graph for one molasses sample. At low non-sugar concentration the molecules are hydrated in solution and the sequestered water is unable to dissolve sugar; hence the coefficient is below 1. At higher concentrations, the sugar and non-sugars form complexes with common hydrate layers and the coefficient rises gradually thereby to about 1·6. At this point, when the non-sugars:water ratio reaches 3:1 the coefficient rises sharply because of the formation of large complexes requiring less water to form a hydrate layer. The authors' proposal to characterise the relationship between the coefficient and non-sugar concentration by a straight line, based on coefficient values, has not been considered expedient by I. E. SADOVOI, who has ignored the relationship in his determinations of the coefficient[2].

* * *

Economizing with Electric Power in Sugar Factories. N. P. FREPON. *Sakhar. Prom.*, 1959, (3), 17–21.—Electric power requirements for various pieces of equipment are discussed and a comparison made of power requirements in kW/100 tons beet for four factories, one of 4000 tons, one of 1800 tons and two of 1000 tons capacity. Advice is given on methods of saving power.

* * *

Rational Organization of Sodium-Ammonium Cation Exchange in Water Treatment. Z. D. DEMCHENKO and M. T. MOLCHADSKII. *Sakhar. Prom.*, 1959, (3), 22–24.—A two-stage method of regenerating sulphonated coal ion exchanger for boiler feed water treatment is described. In the first stage the resin is treated with brine in two lots with an interval of 20–30 minutes between the first third and the second two-thirds. It is then washed with water to remove excess brine and treated with a mixture of sodium chloride and ammonium sulphate in the required proportions, followed by washing until the runnings are free of sulphate.

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Concourse of the NTO (Scientific Technical Department). A. I. SHAPIRO. *Sakhar. Prom.*, 1959, (3), 27–34.—Suggestions submitted in a prize competition for new equipment and processes for beet cleaning and washing are discussed.

* * *

Sand Trap on an Overhead Flume. YU. M. POLYAKOV. *Sakhar. Prom.*, 1959, (3), 34–35.—A sand trap which has given satisfactory results comprises a diffuser screen mounted in the bottom of the overhead flume beneath which is a hopper. The sand and small stones pass through the hopper, at the bottom of which is a Ludlow valve, and down an inclined gutter to a tank from which it is pumped to a waste heap with boiler ash.

[1] *I.S.J.*, 1947, **49**, 205–208.
[2] *I.S.J.*, 1958, **60**, 338.

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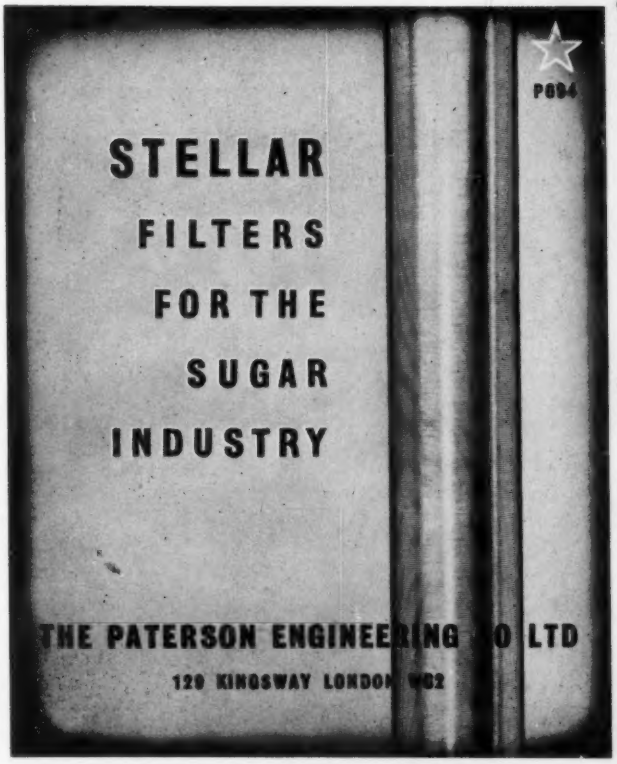

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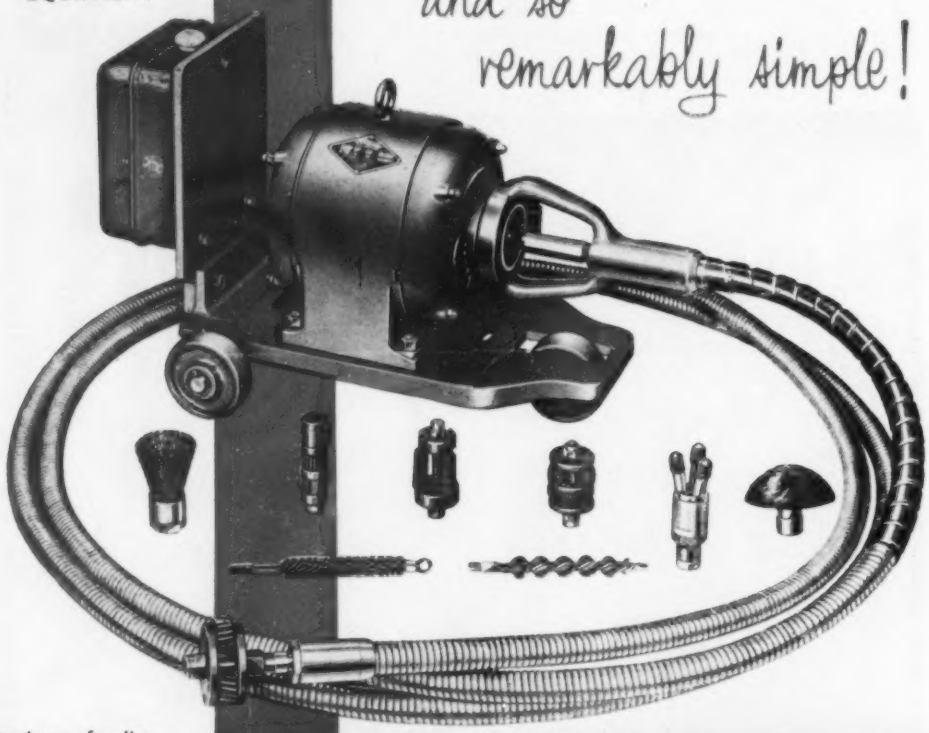

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Pumps for Viscous Fluids. A. Yu. Volokhov and I. I. Sagan'. *Sakhar. Prom.*, 1959, (3), 35–37.—A screw pump with three rotating members is described and illustrated. The central guiding screw is 100 mm in diameter and the two other screws are of 60 mm dia. The double thread screws have a pitch of 3 inches. Throughput against a head of 2·5 atm was 20·5 cu.m. syrup per hour using a 4·5 kW motor at a speed of 1450 r.p.m. With the exit valve closed the pump developed a pressure of 8 atm.

* * *

Increasing Battery Diffuser Capacity. M. P. Priimak. *Sakhar. Prom.*, 1959, (3), 39–41.—The 16-cell battery diffuser at Korenovsk factory was split into two 8-cell diffusers. Sugar losses in molasses were not very different from the original losses, despite the high average temperature of 78–79°C (maximum 83–85°C). The capacity was increased by 25–30%. Deteriorated beets which could not be processed in a rotary diffuser could be handled by the two short batteries by restricting the maximum temperature to 60°C, and using a draught of 140–150%, giving a juice of 68–70 purity and 9–10°Brix.

* * *

Work with a Continuous Rotary Diffuser. M. A. Chermenev. *Sakhar. Prom.*, 1959, (3), 42–43.—An account is given of difficulties encountered with a rotary diffuser when first installed, together with their remedies. Increased diffuser capacity has been achieved by use of automatic and remote control: D.C. generators and shunt-field rheostats were used to regulate the drum speed and slicers over a wide range, permitting uniform charging of cossettes. Automatic water feed was introduced and temperature recording and control used for barometric water, for juice going to the scalder and for the juice going to predefecation. Data are tabulated for 1957 and 1958, before and after installing the automatic controls. With an increase in productivity due to reduced retention time, the losses were reduced and further processing, including filtration, was improved.

* * *

Sugar Losses to Molasses and the Composition of Beet. M. Drachovská and K. Sandera. *Listy Cukr.*, 1959, **75,** 79–80.—The authors calculate molasses production, M, as 8 Pp, where Pp = ash. This is compared with the Smolenski formula, $M = 8{\cdot}5\,Pp - \frac{8{\cdot}50\,Pp}{Dg}$, where Dg = sucrose content. Identical results are given at 17% sucrose, but a difference of about 1% is found at 15% and 20% sucrose. Losses calculated using Lüdecke's formula ($= 5 \times 0{\cdot}85\,Pp + 25\,aN$, where aN = noxious nitrogen) are compared with those using the authors' formula ($= 1{\cdot}2 + 4\,Pp$). The losses calculated using Lüdecke's formula were higher in two examples, being 4·75 and 4·78 compared with 3·61 and 3·84 respectively for sucrose contents of 19·68 and 17·13, although in another example where the sucrose content was 18·00, both losses figures, 3·2% and 3·13%, were much below the actual figure of 3·6%.

Relationship between Dry Solids and Sugar Content of Beet. L. Schmidt and K. Sandera. *Listy Cukr.*, 1959, **75,** 80–81.—Mosel's equation relating beet sugar content and dry solids content, in which the dry solids = 4·8 + 1·14 sugar content, is compared with the Drachovská & Sandera equation[1], rearranged to dry solids = 4·54 + 1·11 sugar content. The dry solids and sugar content of 8 commercial beet varieties in Czechoslovakia were determined and plotted, giving results scattered about a straight line, corresponding to the equation dry solids = 3·35 ± 1·18 sugar content. Over 26 determinations the Drachovská & Sandera equation gave an average dry solids 0·09 lower, and the Mosel equation 0·8 higher than found practically.

* * *

Remelting of Low-Grade Sugar. L. Schmidt, F. Smejkal and K. Sandera. *Listy Cukr.*, 1959, **75,** 81–82.—Comparative analytical results are tabulated for re-melting low-grade sugar at Dymokury, i.e. in thin juice and in diffusion juice. The greatest difference was encountered in the limed thin juice, the ash and colour being better using diffusion juice, and the 1st carbonatation lime salts being lower. In general the differences were not great although remelting in diffusion juice is to be recommended where the low-grade sugar is of average purity and high colour, as the processing is simpler. Remelting in thin juice is recommended if the sugar has a higher purity and low colour. The results confirm those of earlier tests made in the Soviet Union.

* * *

Deionization of Sugar Solutions by Electrodialysis using Ion Exchange Membranes. III. J. Buriánek and D. Slechtová. *Listy Cukr.*, 1959, **75,** 82–83.—The apparatus used to determine the preference in non-sugars removal by means of electrodialysis comprised 10 cation exchange membranes ("Permaplex C-10)" and 10 anion exchange membranes ("Permaplex A-10") mounted between two 5 cm square platinum electrodes, thus providing 21 1-cm spaces. The inorganic salts in treated and untreated dilute molasses were determined by replacing the anions by hydroxyl ions with a strongly basic anion exchanger ("Amberlite LRA-400") and changing the cations to free hydroxide, which were determined by titration. On an average 66% of the electrolytes were removed. Results are tabulated as are those for an approximately 2 : 1 mixture of green syrup and thin juice treated by simple electrodialysis using 1 cation and 1 anion exchanger membrane. Inorganic salts were removed more easily than nitrogenous substances, with practically complete deionization of the green syrup-thin juice mixture. The amount of nitrogenous bodies removed in the form of anions was greater than as cations. Non-sugars of high M.W. tend to choke the membranes, thus shortening their lives and raising the electrical power consumption. This difficulty can be overcome by using the simple electrodialysis technique.

[1] *Shornik VSCHT-FPT*, 1957, **1**, 337-372.

Packing Pumps with a Hydraulic Seal. A. HÜBNER. *Listy Cukr.*, 1959, **75**, 88–89.—A new packing with a hydraulic seal for fluid pumps is described.

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Factory Experiences with the New "J" Diffuser. A. SIPOS, K. HABERÉNYI, M. TEGZE, O. VÁJDA, and K. VUKOV. *Zeitsch. Zuckerind.*, 1959, **84**, 188–192.—Campaign results in 1957/58 and 1958/59 of a 750 tons/day "J" diffuser[1] at Petöháza factory are discussed with illustrations and a brief description of the diffuser. The diffuser was operated without return water, with return of its own press water and with this and press water from a Robert battery diffuser. With return water the losses during both campaigns were lower (0·255% and 0·242% on beet in 1957/58 and 1958/59 compared with 0·337% and 0·284% without. Corresponding draughts were 127·1 and 125·1% in 1957/58 and 125·9 and 125·7% in 1958/59). Invertase activity in the "J" diffuser was 2 to 20 times less than in the Robert battery, and the acid-forming bacterial activity was considerably less, being 6·5 ± 1·5 m.equiv./100 ml/24 hr in the "J" diffuser, and 11·0 ± 0·8 m.equiv./100 ml/24 hr in the Robert battery. The corresponding minimum pH in the "J" diffuser was 5·55 and in the Robert battery 5·10. After disinfecting the Robert battery with sodium hypochlorite and chlorinating the return water to the "J" diffuser, it was found that the number of mesophiles in the "J" diffusion juice was 0·2—2% and the thermophiles 5-10% of those in the disinfected battery. Investigation of the unknown losses caused by bacteria and their enzymes showed that the lactic acid content of the "J" diffusion juice agreed with that of the beet within the limits of accuracy, while considerably more lactic acid was formed in the battery, i.e. 150 mg lactic acid/100°Bx more than in the beet, corresponding to a sugar decomposition of 0·025% on beet as opposed to 0·005% in the "J" diffuser. The invert sugar content of the "J" diffuser was increased by 0·005%, as opposed to an increase of 0·037% in the battery. The return of non-sugars and colloids in press water resulted in a lower raw juice purity than that from the battery, although the thin juice purity was higher. The scalding temperature was 85°C–87°C in 1958/59 for healthy beet, and 73–75°C for frozen beet. Diffusion temperature was 70°–72°C for healthy beet, and 68–70°C for frozen beet.

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Ion Exchangers and Synthetic Resin Adsorbents in the Sugar Industry. R. GRIESSBACH. *Zeitsch. Zuckerind.*, 1959, **84**, 181–187.—The development of ion exchangers and of synthetic resins is reviewed and the problems connected with the use of ion exchange in the sugar industry are investigated. The various stages in sugar production where ion-exchange can be advantageous are discussed and the latest developments (dialysis with permselective membranes, amphylotic deionization, ion exchangers as catalysts and for chemical analysis) are discussed. An extensive bibliography is given.

The Total Diffusion Coefficient of sugar in Extraction from Beet Cossettes. P. V. GOLOVIN. *Ukrain. Khim. Zhurn.*, 1958, **24**, 554–556; through *S.I.A.*, 1959, **21**, Abs. 143.—The total (molecular + convective) diffusion coefficient of sugar in the extraction from cossettes can be derived in terms of diffusion through a double layer consisting of the cossette and the surface film :

$$D = \frac{(\delta_1 + \delta_2)\,\alpha_1\,\alpha_2}{\delta_1\,\alpha_2 + \delta_2\alpha_1}$$

where δ_1 is the cossette thickness, δ_2 is the thickness of the surface film (both in metres), α_1 is the molecular diffusion coefficient in the cossette, and α_2 is the corresponding coefficient in the surface liquid film (both in sq.m./hr). If the film thickness is a fraction μ of the cossette thickness, this becomes

$$D = \frac{(1 + \mu)\,\alpha_1\,\alpha_2}{\alpha_1\,\mu + \alpha_2}$$

It follows that cossette thickness is the principle factor in the process ; with increase of the juice velocity the film thickness decreases, and the process is more rapid because of the decrease of the diffusion path, although the total diffusion coefficient gradually decreases and approaches the molecular diffusion coefficient in the cossette.

* * *

Instrumentation and Control Problems of the J-Diffuser. B. PATAKY and M. TEGZE. *Elelmezési Ipar*, 1958, **12**, 344–354; through *S.I.A.*, 1959, **21**, Abs. 145.—The plant at Petöháza factory is described and the controls relating to the continuous J-diffuser are discussed in detail. Pan work can be regulated by attaining the optimum concentration of thick juice, arranging vapour withdrawal as necessary. From the results in 42 Czech factories, the mean heat consumption is 2,721 Mcal/ton for the production of raw sugar of 100 rendement. A drop in sugar content in beet by 1% means an increase in heat of 145 Mcal/ton, which corresponds roughly to theoretical calculations. An optimum value can be used for comparisons.

* * *

Basic Fundamentals, Design and Application of Hydrocyclones. S. BEDNARSKI. *Gaz. Cukr.*, 1959, **61**, 39–47, 72–82.—The fundamentals of hydrocyclone technology and design are presented with numerous illustrations and diagrams and with 42 references to the literature. The use of hydrocyclones to remove impurities from flume water and milk-of-lime, to clarify 1st and 2nd carbonatation juice and defecation juice, and to thicken diluted muds, is discussed in detail. Diagrams of various schemes are given as well as tabulated data from several Polish factories.

* * *

Automation in Sugar Factories. F. PRIDAL. *Listy Cukr.*, 1959, **75**, 105–113.—Automatic control is discussed generally, particular applications in various sections of the factory being dealt with in detail.

[1] *See I.S.J.*, 1958, **60**, 178.

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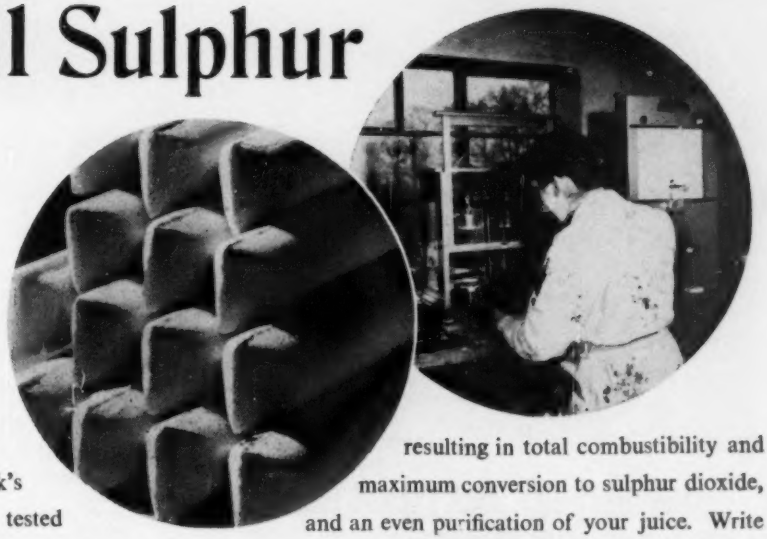

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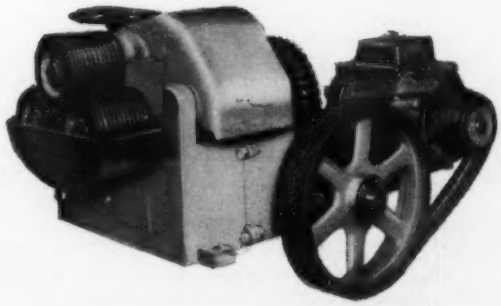

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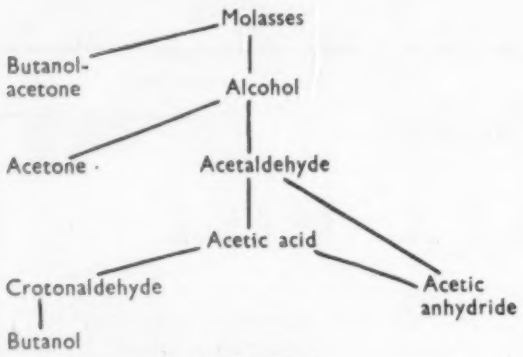

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Regression Analysis as applied to some Control Data in Raw Sugar Factories. R. F. INNES. *Jamaican Assoc. Sugar Tech. J.*, 1957, **20**, 55–71.—See *I.S.J.*, 1959, **61**, 283.

* * *

Study on the Nature of the Alkalinity of First and Second Carbonatation Juices in the Sugar Factory. A LEMAITRE and M. ROCHE. *Chim. & Ind.*, 1959, **81**, 78–82.—Potentiometric titration and back-titration of first and second carbonatation juices can be used to determine the OH^- and CO_3^{--} and the CO_3^{--} and HCO_3^- contents, respectively, so that the curves obtained may be used to determine the optimal alkalinity of second carbonatation, whereat the presence of HCO_3^- is avoided.

* * *

The Use of Sucrose Solution for the Determination of "Available CaO" in Commercial Lime. E. WALSH, B. F. WRIGHT and J. B. ALEXANDER. *S. African Sugar J.*, 1959, **43**, 61–63.—Extraction of commercial lime with various sucrose solutions showed that the quality of sugar used (mill white, refined, analytical reagent quality) had a definite and measurable effect on the available CaO found. The presence of soluble manganese and reducing sugars (to a less extent) reduces the value obtained, and hence makes the method unreliable. Extraction with 5% phenol does not suffer from these defects.

* * *

Polarographic Determination of Sugar in Sugar Beet Molasses. M. S. SHUL'MAN and V. E. SEMEVSKAYA. *Spirtovaya Prom.*, 1958, **24**, (4), 13–15; through *S.I.A.*, 1959, **21**, Abs. 44.—A calibration graph showing the wave height as a function of invert concentration in sucrose, after hydrolysis with HCl and neutralization with CaO, is first plotted. The molasses is similarly hydrolysed, and its wave heights are determined before and after hydrolysis. The calibration graph is used to find the sucrose concentration in the original molasses from the difference between these wave heights. A dropping mercury electrode is used; the polarographic procedure is not described. Sources of error and effects of interfering substances are briefly discussed. An editorial note points out that the other reducing substances, in addition to fructose, are reduced at the same half-wave potential.

* * *

Factory Research in Hawaii. ANON. *Rpt. Expt. Sta. Comm. H.S.P.A.*, 1958, 28–31.—Investigations have shown that colour, ash and methanol-insoluble matter increased with increasing sugar crystal size; this is believed to be due to occlusion of mother-liquor. The colour-bearing compounds in raw sugar have been classified into four groups: naturally-occurring plant pigments; thermally-degraded carbohydrate products; alkali-degraded carbohydrate products; and melanoidins produced by reaction between amino-acids and the carbohydrate degradation products. The starch content of raw sugars was shown to be a varietal and not a locational variable. The effect of various materials on sucrose crystallization rate has been studied; glucose, fructose, sodium hydrosulphite and manganous sulphate all increase the rate but the effects are more than counter-balanced by the strong rate-decreasing effect of potassium chloride. Sodium sulphite has also been found to diminish the rate of crystallization. Juice purification tests with an ion exchange membrane technique, in which the anion-exchangers were strong-base type resins, backed with glass fabric, have been carried out and these membranes shown to have low initial resistance and to foul less rapidly than previous types. Two new routine methods adopted as standard in Hawaiian laboratories are a dry screening test for determination of small grain and the use of the Beckman sugar colorimeter[1].

* * *

Developments in Methods for Microbiological Control in Liquid Sugar. H. E. HALDEN, D. LEETHEM and F. G. EIS. *J. Amer. Soc. Sugar Beet Tech.*, 1958, **10**, 138–141.—The sample examined should be representative of the whole volume of liquid sugar and a sampling device designed to ensure this is described. A ¼-inch permanent by-pass from the delivery line delivers, via a pet-cock, into a sterile jar which has a threaded mouth fitting into a threaded cap surrounding the end of the by-pass. Thus a sample is continuously taken of the liquid sugar passing through the delivery pipe, the amount taken being governed by the pet-cock setting so that the whole sample fills the jar. Analytical procedures are referred to and the membrane filter technique recommended.

* * *

The Rôle of Amino-Acids of Cane Juices. I. Identification of Amino-Acids in Sugar Cane Juices at Different Periods of the Plant Growth. S. C. SEN and J. C. BHARGAVA. *Proc. 26th Sugar Tech. Assoc. India*, 1958, 1–13.—Juices were filtered through kieselguhr; passed and recycled through "Duolite C3" cation exchanger until all the amino-acids were adsorbed; the resin washed with distilled water to remove the sugar; the amino-acids eluted with 6N ammonia and the eluate concentrated in vacuo. The concentrates were chromatographed on paper with known samples and the spots developed with ninhydrin. The maximum number of acids was detected in November-

[1] *I.S.J.*, 1956, **58**, 25.

December, and the minimum in the peak maturity period February-April. Altogether 11 acids were identified.

* * *

Automatic Juice Sampling. Arrangement for Cane Quality Scheme. II. R. C. SHARMA. *Proc. 26th Conv. Sugar Tech. Assoc. India*, 1958, 27–34.—The arrangement previously described in detail[1] has been put into operation with modifications to reduce the units sampled from 2½ to 1½ tons of cane.

* * *

A New Indicator for Study of pH 10·5 in the First Carbonatation Process. N. A. RAMAIAH, R. K. CHATURVEDI and R. SHYAM. *Proc. 26th Conv. Sugar Tech. Assoc. India*, 1958, 43–47.—An indicator suitable for marking a distinct end-point is prepared by mixing 0·1% solutions in 50% alcohol of thymolphthalein and phenolphthalein. (The proportions are given as 3:1 and 1:3 on different pages—Ed.).

* * *

Formation of Colour Limits for Refined Sugar. N. A. RAMAIAH and B. D. KAPOOR. *Proc. 26th Conv. Sugar Tech. Assoc. India*, 1958, 49–54.—Absorptions over the range 400–700 mμ were measured for 19 samples of refined sugar from various parts of the world. A characteristic peak with sugar solutions occurs at 420 mμ, the absorption decreasing rapidly thereafter with increasing wavelength. The refined sugar can be characterised by measuring the absorption at 420 mμ and 550 mμ, and the limits proposed are: $\epsilon_{420} \not> 85 \times 10^{-3}$ and $\epsilon_{420} - \epsilon_{550} \not> 45 \times 10^{-3}$.

* * *

Control of Boiler Feed Water. J. C. de FONTENAY. *Rev. Agric. Sucr.* (Mauritius), 1958, **37,** 348–350.—A Worthington de-aerator is installed at Union Flacq, and routine oxygen analysis is carried out on feed water entering and leaving. The method used is based on the oxidation under alkaline conditions of manganous hydroxide to manganic hydroxide, and values are reduced from 4–7 p.p.m. to 0·05–0·1 p.p.m. Oil in pan condensates is measured as a function of the turbidity by means of a Photovolt colorimeter with the 100% reading adjusted to distilled water. The oil content is read from a graph previously prepared using emulsions of known oil content.

* * *

Establishment of a Rendement Formula. H. BAYSAL. *Seker*, 1959, (30), 16–17.—A rendement formula $x = \frac{10^4(Q - Q_m)}{Q(100 - Q_m)}$ is developed and it is shown that an increase in syrup and massecuite purity (Q) or decrease in molasses purity (Q_m) increases rendement (x).

* * *

Use of Disodium Ethylene Diamine Tetraacetate in Estimation of Hardness Value of Cane Sugar Factory Juices. S. P. SANYAL. *Indian Sugar*, 1959, **8,** 609–611.—The use of EDTA titration for estimation of hardness in cane juices is examined and results tabulated from analysis of juice to which known amounts of $CaCl_2$ solution had been added. The EDTA method is considered to give fairly accurate and quick results.

* * *

The Effect of Electrolytes on the Crystallization and Dissolution Rates of Sucrose. F. SCHNEIDER, A. EMMERICH and K. JÖRN. *Zucker*, 1959, **12,** 118–122.—Methods for determining the rate of crystallization of sucrose are discussed and experiments described for measuring the rate of dissolution of sucrose. A known weight of crystals is introduced into a solution of known undersaturation, stirred in a vessel held at 20°C in a thermostat. The refractive index of the mother liquor is measured at regular intervals. It is found that the decisive factor is the activity rather than the concentration of the sucrose and that the rate of dissolution follows a first order equation in terms of activity. Electrolytes present affect the rate only at higher concentrations, when a decrease is observed, ions of the smallest radius having the greatest effect (this applies to halides of the same metal as well as to alkaline earth salts of the same anion).

* * *

An Improved Method of Determining Reducing Substances. V. M. KATS and M. I. SHOIKHAT. *Sakhar. Prom.*, 1959, (2), 35.—It is considered that the quantitative determination of reducing sugars using Fehling's solution is not sufficiently accurate, as the solution itself deposits cuprous oxide, thus upsetting the ratio between reducing sugars and the precipitate. It is therefore recommended that the Rochelle salts in the B solution be replaced by trihydroxyglutaric acid. Thus the composition of the solutions is given as: A — 40 g $CuSO_4$, $5H_2O$ per litre of solution, and B — 128 g trihydroxyglutaric acid and 207 g NaOH per litre. The amount of reducing sugars (x) is given by $x = KT$, where T is the amount of copper in the precipitated oxide, and K a coefficient given as 0·6068 for glucose, 0·6027 for fructose, 0·6047 for invert sugar and 0·9383 for maltose.

* * *

Unknown Losses. A. SINGH. *Sugar y Azúcar*, 1959, **54,** (3), 30, 41.—Cf. *I.S.J.*, 1958, **60,** 366.

* * *

Enzymatic Formation of Oligosaccharides in Alcoholic Fermentation. E. MARIANI and L. FRANGUELLI. *Ricerca Sci.*, 1958, **28,** 2296–2299; through *S.I.A.*, 1959, **21,** Abs. 97.—Paper chromatography of the musts during the process of alcoholic fermentation has shown the presence of oligosaccharides formed by the action of the enzymes. It is also claimed that a solution of pure glucose and fructose, in equal amounts, in distilled water buffered to pH 4·5 (acetic acid—sodium acetate) also yielded increasing amounts of oligosaccharides under the action of invertase (B.D.H.) for seven to 17 days. It is thus suggested that the presence of sucrose is not essential to transfructosidation or transglucosidation reactions.

[1] *I.S.J.*, 1958, **60,** 275.

Method for Determining the Sub-Sieve Particle Size Distribution of Pulverized Sugar. C. E. KEAN. *Food Res.*, 1958, **23**, 677–683; through *S.I.A.*, 1959, **21**, Abs. 102.—The particle size distribution is calculated from the successive weights of sugar in the 10 ml samples of sugar suspension in dry (redistilled) isopropyl alcohol taken from an Andreasen pipette (sedimentation) assembly. The sugar is weighed after evaporation of the samples in the tared aluminium dishes. The apparatus and method are described in detail, with the derivation of the formula used. A 1·5% powdered sugar suspension was the optimum for the determination. A number of suspension media and dispersing agents was tested; isopropyl alcohol with 0·2% of Twitchell 8240 dispersing agent was found to be most suitable. Typical particle size distributions are tabulated. Good reproducibility was attained. Partial checks on the method, by screening (325 mesh) and by photomicrographs showed good agreement for the larger size particles thus tested. Starch-free sugars and sugars containing up to 8% of starch have been sucessfully analysed.

* * *

The Indirect Microdetermination of Fructose and Inverted Sucrose with Sodium Cuprithiosalicylate. C. RABEGA, M. RABEGA and R. STANESCU. *Analele Univ. "C. I. Parhon", Bucuresti, Ser. Stiint. Nat.*, 1957, (16), 111–116; through *Chem. Abstr.*, 1958, **53**, 133.—A standardized 2% solution of sodium cuprithiosalicylate has been used to determine the amount of fructose in solutions containing 2–10 mg of fructose and also in solutions containing mixtures of fructose and glucose resulting from the inversion of sucrose. The procedure involves the Haen and Low method for the iodometric titration of Cu^{II} left in 10 ml of the reagent in the presence of various amounts of sugar, and can be used for the indirect microdetermination of inverted sucrose. The amount of sucrose can be calculated for the invert content by multiplying by a factor of 0·95. The method is very exact because the experimental errors are practically negligible. The time for one microdetermination is about seven minutes.

* * *

Application of the Alkaline Potassium Ferricyanide Method in the Estimation of Reducing Sugars in Sugars. J. C. BHARGAVA and S. C. SEN. *Proc. 26th Conv. Sugar Tech. Assoc. India*, 1958, 103–110.—The SEN and GHOSHAL technique[1] was applied to solutions of refined sugars containing invert. It became clear that the sucrose had an appreciable effect on the results which indicated lower reducing sugar with increased sucrose content, e.g. 20 cc at nil sucrose reducing to 18 cc at 25% sucrose for the same amount of invert. A set of tables is drawn up indicating the reducing sugar content of solutions containing 0, 1, 2, 5, 10, and 25% sucrose, corresponding to the volume required to titrate 20 cc of the ferricyanide solution. The method is of comparable accuracy with the Luff-Schoorl method but its results differ from those given by the Fehling method.

Hardness of Sugar Cubes. N. A. RAMAIAH and S. K. D. AGARWAL. *Proc. 26th Conv. Sugar Tech. Assoc. India*, 1958, 141–153.—An instrument is described for measuring the hardness of cubes. Hydraulic pressure is developed by a handwheel and applied to the cube; the pressure developed before the cube breaks is a measure of its hardness. Hardness is shown to depend on, among other things, moisture content and grain size of the sugar used, and the pressure employed.

* * *

Use of Continuous Automatic Analyser for Detection of Sugar in Evaporator Condenser Water. E. BAUM. *Paper presented to the 18th Ann. Meeting, Sugar Industry Technicians Inc.*, 1959.—The application of continuous automatic sugar determination in steam condensate returning to the power plant is discussed, as is the application of the same equipment to determine the degree of sugar losses in condensate waters in barometric condensers used on pans and evaporators.

* * *

Investigations of the Fate of Glucose in the Processing of Sugar Cane Juice Utilizing Radioactive Tracer Techniques. L. F. MARTIN and W. W. BINKLEY. *Paper presented to the 18th Ann. Meeting, Sugar Industry Technicians Inc.*, 1959.—Seven millicuries of uniformly-labelled carbon-14 D-glucose were added to 300 gallons of mixed raw juice which was then processed under simulated mill conditions at Audubon sugar factory of Louisiana State University. The processing of the juice is described with particular emphasis on the sampling of intermediate products. The results from preliminary qualitative radio-assays of these products are presented and certain implications discussed.

* * *

Routine Determination of Colour. S. BORODKIN and M. DMITROVSKY. *Paper presented to the 18th Ann. Meeting, Sugar Industry Technicians Inc.*, 1959.—The sugar industry has long been interested in obtaining a reliable photoelectric method for routine determination of colour. A survey was undertaken of the methods recommended under Subject 13 (Colour and Turbidity of Sugar Products) of ICUMSA and of papers on colour presented at the September 1958 meeting of the American Chemical Society. In conjunction with this survey, the Beckman Sugar Colorimeter[2] was evaluated. Modifications of this instrument and design of new test cells are described. The estimated values obtained using the Beckman Sugar Colorimeter with various methods were compared statistically with visual rank. The E_{NBS} method gave the best correlation. A modified procedure based on E_{NBS} is presented.

* * *

Alkali Metal Derivatives of Sucrose. I. Preparation of Sodium Sucrates. P. C. ARNI, W. A. P. BLACK, E. T. DEWAR, J. C. PATERSON and D. RUTHERFORD. *J. Appl. Chem.*, 1959, **9**, 186–192.—Sodium derivatives

[1] *Indian Sugar*, 1952, **1**,(10).
[2] *I.S.J.*, 1956, **58**, 25.

of sucrose have been prepared in a number of solvents. Reactions with sodium in pyridine and morpholine at 110°C give products which are not true substitution derivatives but analyse more closely to sodium hydroxide addition compounds containing varying amounts of solvent. In liquid ammonia, sucrose reacts with sodium at –33°C to give true sodium sucrates, $C_{12}H_{22-x}O_{11}Na_x$, provided extreme care is taken to exclude moisture at all stages in the preparation. Monosodium sucrate is a crystalline material containing one molecule of ammonia, but the higher sucrates are white hygroscopic powders containing very little ammonia. Sucrates can also be prepared with sodamide in liquid ammonia, and this method is suitable for highly substituted derivatives up to the heptasodium derivative. Two methods are described for the estimation of sucrose in sodium derivatives.

* * *

Chemical Control in the Sugar Factory. J. R. LECLÉZIO. *Rev. Agric. Sucr.* (Mauritius), 1958, 37, 332–341.—New methods and calculations which should be incorporated in chemical control of factories are discussed. They include determination of cane sucrose content by use of a high-speed disintegrator; calculation of the efficiency of individual mills from the general formula $E_n = \frac{100\,(\sigma_{n-1} - \sigma_n)}{\sigma_{n-1}}$, where E_n is the extraction of the nth mill, and $\sigma_n = S_{Bn}/F_{Bn}$ where S_{Bn} and F_{Bn} are sucrose and fibre, respectively, in bagasse from the nth mill. Efficiency of clarification can be measured as the non-sugar removed from mixed juice to clear juice, expressed as a proportion of the original non-sugars in mixed juice. Filtration yield may be expressed as the insolubles retained by the filter % insolubles in muds. Control of boiling is discussed with particular attention to molasses viscosity. Also discussed are molasses exhaustibilty, microbiological control and analysis of boiler feed and waste waters.

* * *

Ammonium Molybdate as Spraying Agent for Paper Chromatograms of Reducing Sugars. H. EL KHADEM and S. HANESSIAN. *Anal. Chem.*, 1958, **30,** 1965; through *S.I.A.*, 1959, **21,** Abs. 109.—The use of a 10% solution of ammonium molybdate (alone) as a spray for sugar spots on chromatograms gives better results than the use of molybdate with HCl and NH_4Cl (*cf. Arch. Biochem.*, 1950, **28,** 424) since the background remains colourless and is generally less sensitive so that it does not show heat marks on being rolled and oven-dried. Spots containing 25 γ each of xylose, arabinose, rhamnose, glucose, mannose, galactose, fructose, sorbose, glucosamine hydrochloride, maltose and lactose were detected with such a spray (on heating to 100°C for 10 min) and were yellow at first and turned blue-grey after six hours.

* * *

Application of Chromatographic Methods to Sugar Factory Problems. G. TORRACA. *Pubbl. Univ. Cattolica S. Cuore, Ann. Fac. Agrar., Ser.* 5, *Atti Convegno Appl. Tec. Cromatogr. Prod. Agr.*, 1957, **53,** 115–137; through *Chem. Abstr.*, 1958, **52,** 21179.—A review is given of chromatographic techniques for detecting non-sucrose sugars in sugar factory products (46 refs.). The technique of STEIN and MOORE was used for the determination of amino acids in beet molasses; concentrations found were (mg/g of molasses): aspartic acid 1·91, threonine 0·17, serine 0·46, glutamic acid 4·99, proline (not determined), glycine 1·14, alanine 5·64, valine 1·79, methionine (?) 0·21, *iso*leucine 3·19, tyrosine 4·73, phenylalanine 0·11, γ-aminobutyric acid 2·40, lysine 0·52, and arginine 0·26. Similar data for the composition of two foreign molasses are tabulated.

* * *

The Effect of some Pectin Substances on Sucrose in Aqueous Solutions. G. B. AIMUKHAMEDOVA, E. P. RUKAVISHNIKOVA and Z. P. KOVALENOK. *Izvest. Akad. Nauk Kirgiz S.S.R.*, 1956, **4,** 119–135; through *S.I.A.*, 1959, **21,** Abs. 120.—Causes of the adverse effects of pectins in sugar manufacture were studied. Pectic material, consisting of calcium and magnesium pectates, was extracted from sugar beet. Sucrose added to a solution containing 1–3 g of the pectates per 200 ml at 80°C disappeared rapidly. It was shown that the pectate mixture itself yields only a very small amount of reducing sugars under similar conditions, and that inversion of sucrose is accelerated by "active" pectin substances. The nature of such "active" substances and of their action is not understood. In sugar production, this action results in loss of sucrose in the form of glucose and fructose, with an increase in the viscosity of the syrups and in the solubility of sucrose, leading to increased losses. The effect should be reduced by prevention of the entry of pectic substances into diffusion juice; this can be achieved by the use of oxidation inhibitors during the diffusion process.

* * *

An Electronic Moisture Meter. L. CIFRA. *Proc. Philippines Sugar Tech. Conv.*, 1956, 38–42.—A description and circuit diagram are given for a direct reading capacity meter for measuring the moisture content of sugar samples contained in a glass cell. There is no provision for temperature compensation or external electrostatic influences, yet the accuracy appears to be within 3%.

* * *

An Automatic Sugar Sampler. C. M. MADRAZO. *Proc. Philippines Sugar Tech. Conv.*, 1956, 43–45.—On the side of the hopper below the sugar scale is welded a ¾-inch pipe which, two-thirds down its length, passes through a rubber stopper, which fits a hole in the copper cover of a sugar sample jar. The jar is thus connected with the inside of the hopper and receives sufficient sugar for analysis and control purposes when a strike passes from the scale into the hopper.

* * *

Rapid and Equitable Distribution of Planters' Molasses. T. R. ANCHETA. *Proc. Philippines Sugar Tech. Conv.*, 1956, 267–274.—The various systems of calculating

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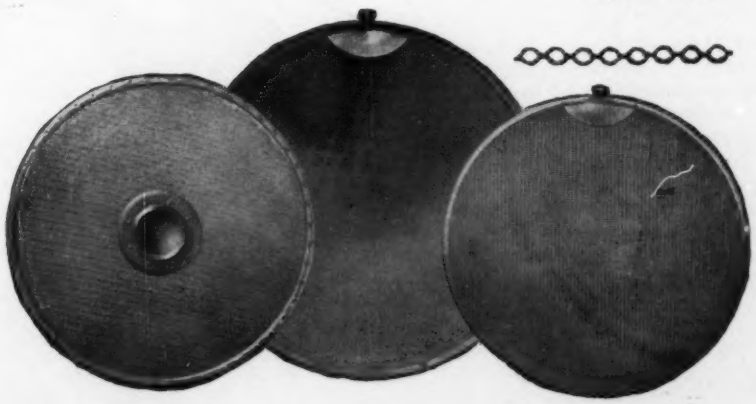

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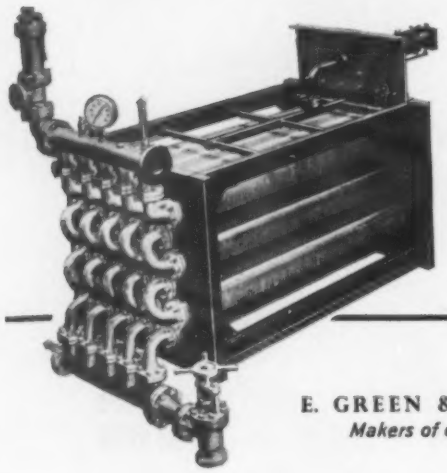

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GK. 167

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A stronger chain also recommended for this work is Pennine Combination Chain—a combination of malleable iron centre-links and high-carbon steel side-bars. Both these chains require K1 or K2 links spaced at intervals for elevator bucket attachment.

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[1] *I.S.J.*, 1950, **52**, 127, 151, 267; 1951, **53**, 12, 337; 1953, **55**, 52.
[2] LUNT and SUTCLIFFE: *I.S.J.*, 1954, **56**, 84.

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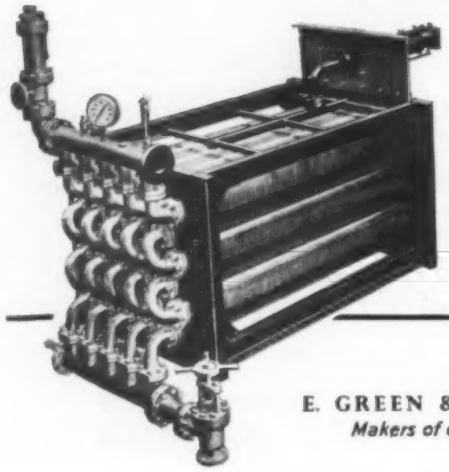

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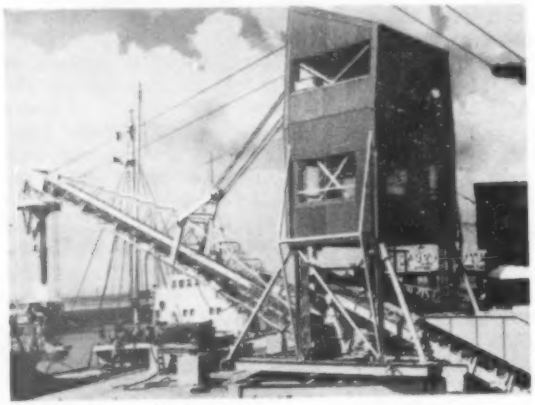
TRADE NOTICES

Statements published under this heading are based on information supplied by the firm or individual concerned. Literature can generally be obtained on request from the address given.

Bulk Cargo Loader. Crone & Taylor (Engineering) Ltd., Sutton Oak, St. Helens, Lancs.

The loader is mounted on rails for operation along the wharf, and its conveyor-supporting superstructure is mounted on a power-operated turntable. Material to be loaded is delivered by conveyor to the feed hopper and thence to the 60-ft main conveyor boom. It falls through a fibreglass telescopic chute into a "Meteor" thrower. A ball thrust ring encircles the feed chute and permits free rotation in the hold by means of hand lines controlled by one man. All operations are effected by one man, using a push-button system in the control room on the upper



(Photo courtesy I.C.I. Ltd.

floor of the tower. Automatic trip and overrun switches are provided and the assembly can handle a throughput of 300 tons per hour.

* * *

Cary Cane Harvester-Cleaner-Loader. Logan Perkins, International Trade Mart, New Orleans, La., U.S.A.

Midway during the 1957 Louisiana sugar cane harvest, the heaviest rains in 25 years flooded the fields and the harvest ended with thousands of tons of cane left in the field. As a result, a group of prominent planters co-operated financially in the development, for testing in 1958, of the new Cary cane harvester-cleaner-loader which is designed primarily to deal with recumbent cane. The machine was taken to Florida after the Louisana season and operated without a major breakdown in both areas, successfully handling the lighter crops in Lousiana and the 60–80 ton/acre crop in Florida. The trash figure was higher at first than with conventional Lousiana equipment, but addition of a topping blade improved the trash in favour of the Cary Machine. Authorities in Clewiston, Florida, believe that the machine will handle 300 tons of cane per day with sufficient hauling equipment. It not only harvests, cleans and loads the cane but also cuts it into either 15–or 22–inch lengths.

Its efficiency is demonstrated by the clean appearance of the ground it has passed over, as shown in the illustration.

* * *

PUBLICATIONS RECEIVED.

THE CUSTOM "8000" ELECTRIC MOTORS. General Electric Company, Schenectady, N.Y., U.S.A.

New manufacturing techniques and materials have contributed to the development of a completely new motor which, according to Bulletin GEA 6865, is designed to provide longer motor life, reduced maintenance and in some cases lower cost inclosures. The motors are available in 150 h.p. and larger sizes.

* * *

FILTERS. Maschinenfabrik Buckau R. Wolf A.G., Grevenbroich-Neuss, Germany.

A new leaflet, F 1080, describes and illustrates the filters supplied to sugar factories by Buckau-Wolf. They include their well-known rotary vacuum filters and also the Stellar filters and the leaf and tubular pressure type filters made under licence.

* * *

CROFTS "RITESPEED" GEARED MOTORS. Crofts (Engineers) Ltd., Thornbury, Bradford 3, Yorks.

The "Ritespeed" range of geared motors is available in powers from 1 to 20 h.p., and can be mounted on the floor, ceiling and walls—with axis horizontal or vertical. The specifications of the range are given in Publication 5950, which also provides information on mounting, lubrication, etc.

* * *

VIBRATING SCREENS. Link-Belt Company, Prudential Plaza, Chicago 1, Ill., U.S.A.

Book No. 2777 describes and illustrates each of the screens in the wide Link-Belt range which includes 12 different types and 212 sizes. It gives complete tables of material selection, construction features, etc., and also provides information on screen cloths and other accessories.

BREVITIES

Puerto Rico Sugar Crop, 1959.[1]—Production of the 1959 sugar crop in Puerto Rico finished on 9th July when Central Fajardo, the 29th mill, shut down. Total production for the Island is reported at 1,072,673 short tons of raws, falling short by 213,702 short tons of their quota of 1,286,375 tons.

* * *

Townsville Terminal in Operation.[2]—The new bulk sugar terminal at Townsville, Queensland, started taking in sugar before completion of the wharf end of the shed. The terminal was expected to be ready for outloading cargoes of bulk raws by the 20th August.

* * *

New Italian Sugar Factory.[3]—The Società Italiana per l'Industria degli Zuccheri S.p.A. has started to construct a sugar factory in the neighbourhood of Melfi, Potenza, which is of 2200 tons daily capacity and should be completed in June 1960.

* * *

Italian Sugar Technologists' Golden Jubilee.—The 1959 Meeting of the Associazione Nazionale fra i Tecnici dello Zucchero e dell'Alcole, the Italian Sugar and Alcohol Technologists' Association, held in Ferrara last June, was the occasion of the 50th anniversary of the founding of the Association. A special issue of *Industria Saccarifera Italiana* has been published to mark the occasion when, also, in addition to several eminent Italians, the Association honoured Prof. J. DUBOURG, Prof. H. HIRSCHMÜLLER, Mr. J. CAMPBELL MACDONALD and the late Prof. K. SANDERA by appointing them Honorary Life Members of the Association in recognition of their services to the sugar industry.

* * *

United States Supply Quota, 1959.[4]—Deficits in the quotas of Puerto Rico, Hawaii and Virgin Islands totalling 300,000 tons in all were announced by the U.S. Department of Agriculture on 6th August. Puerto Rico's quota was reduced by 196,500 short tons, bringing it to 969,875 tons, Hawaii lost 100,000 tons leaving a quota of 1,015,479 tons and, with a reduction of 3,500 tons, the Virgin Islands' entitlement became 12,405 tons. It was also announced on 3rd September, that, in view of the increasing demand for sugar, the Department of Agriculture had increased the Supply Quota by 100,000 short tons, bringing it to 9,300,000 tons. This additional tonnage was distributed in the manner prescribed under the Sugar Act but Puerto Rico and Virgin Islands, which territories had already declared deficits, found it impossible to accept the additional allotments of 13,062 tons and 178 tons respectively and these were redistributed. Hawaii having declared a deficits at an earlier date also found it impossible to accept the 12,491 tons offered and in addition declared a deficit of 37,509 tons, making 50,000 tons in all which was also redistributed.

Details of individual Quotas as adjusted are as under :—

Raw Sugar Value	*Short tons*	*Short tons*
Domestic Beet	2,225,264	1,986,843
Mainland Cane	684,735	611,370
Hawaii	977,970	873,187
Puerto Rico	969,875	865,960
Virgin Islands	12,405	11,076
Philippines	980,000	875,000
Cuba	3,186,316	2,844,925
*Full-duty Countries	263,435	235,210
	9,300,000	8,303,571
*of which :—		
Peru	91,197	81,426
Dominican Republic	76,507	68,310
Mexico	59,709	53,312
Nicaragua	13,453	12,011
Haiti	6,806	6 077
Other Countries	15,763	14,074
	263 435	235 210

New Chilean Sugar Factory.[5]—Industria Azucarera Nacional S.A. plan to erect a fourth sugar factory near Ninquihae in the province of Nuble.

* * *

Libyan Factory Proposal.[6]—The Provincial Government of Tripoli are considering the erection of a sugar factory on the basis of the good results from beet cultivation trials.

* * *

Sugar Expansion in Kenya.[7]—It is reported that Uganda Sugar factory Ltd. have completed the purchase of the Muhuroni sisal estate of 8500 acres and that it will now be developed as a sugar plantation with a factory; it is expected that many farmers in the area will now start to plant cane for sale to the factory.

* * *

Sugar in Afghanistan.[8]—The area planted to sugar beet in Afghanistan was 3400 hectares in 1958 compared with 3500 in 1957. The beet crop dropped from 36,800 tons to 35,400 tons in 1958, while the sugar produced was 5200 tons, compared with 5300 tons in 1957.

* * *

Sugar Factory Automation in the U.S.S.R.[9]—The Drokiewsk sugar factory in the Moldavian S.S.R. will be the first to be constructed in the U.S.S.R. in which all the technological processes are controlled automatically by instruments. At first particular stations will be controlled automatically and these later integrated to a continuous process. It is expected thereby to increase sugar production by 1100 tons per year.

* * *

Ghana Sugar Industry.[10]—Ghana plans to start a national sugar industry, to be situated in the Trans Volta/Togoland district. Cane is to be grown in Ghana and processed into white sugar in the new sugar factories. Molasses is to be converted into alcoholic beverages while the bagasse will be used in paper-making. The necessary machinery has been ordered in Western Germany.

* * *

Greek Sugar Factory.[11]—The contract for the first factory to be built in Greece has been awarded to two German firms—Buckau R. Wolf and B.M.A.—in recognition of the high repute of their factories and their experience, and in spite of their bids being some $285,000 higher than two other tenders. The total cost of the 2000-ton factory at Larissa will be about $7·5 million, of which $5 million will have to be paid in foreign exchange largely covered by German credits.

* * *

French West Indies Sugar Production.[12]—Guadeloupe produced 117,000 tons of sugar in 1958 and Martinique 70,000 tons. Both crops fell far below estimates for the year. Plentiful rain which raised the cane crop to what would have been a record persisted through the grinding operations and much of the crop was left standing in the fields. A record crop of over 1½ million tons of cane, which should yield about 140,000 tons of sugar, is estimated for Guadeloupe in 1959. Martinique expects to produce 70,000 tons of sugar this year.

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[1] *Willett & Gray*, 1959, **83**, 284.
[2] *Australian Sugar J.*, 1959, **51**, 379.
[3] *Zeitsch. Zuckerind.*, 1959, **84**, 416.
[4] C. Czarnikow Ltd. *Sugar Review*, 1959, (418), 135; (422), 150
[5] F. O. LICHT, *International Sugar Report*, 1959, **91**, (Supp. 16), 212.
[6] *Zeitsch. Zuckerind.*, 1959, **84**, 417.
[7] *Overseas Review* (Barclays D.C.O.), 1959, July/August, 36.
[8] F. O. LICHT, *International Sugar Report*, 1959, **91**, (Supp. 17), 232.
[9] F. O. LICHT, *International Sugar Report*, 1959, **91**, (8), 77.
[10] F. O. LICHT, *International Sugar Report*, 1959, **91**, (Supp. 16), 213.
[11] F. O. LICHT, *International Sugar Rept.*, 1959, **91**, (Supp. 14), 187.
[12] *Foreign Trade*, 1959, **112**, (3), 23.

BREVITIES

Kawaihae Harbour Opens.[1]—The first commercial use of the Kawaihae terminal[2] in Hawaii took place on the 25th June when a 14,000-ton tanker was loaded with about 7000 tons of molasses destined for the U.S. mainland. The terminal has a 10,000-ton molasses storage capacity, while the bulk sugar capacity will be 14,000 tons when the storage-loading installation is completed.

* * *

Pakistan Sugar Results, 1958/59.[3]—The 1958/59 campaign in Pakistan ended on the 15th July with a production of 120,115 tons of 96° raw sugar equivalent in West Pakistan from 1,519,469 tons of cane, and 57,479 tons of sugar from 637,138 tons of cane in East Pakistan, giving a total of 177,574 tons of sugar from 2,156,607 tons of cane. The season was extremely long, Charsadda and Premier mills crushing for 240 and 238 days, respectively. The cane area was smaller than in 1957/58 (1,158,000 acres *vs.* 1,234,000) and the yield was also lower at 11·32 tons/acre compared with 11·76 in 1957/58. Premier Sugar Mills produced 394 tons of white sugar from 3062 tons of beet, crushing this together with cane, and a similar process was used at Leiah and Charsadda mills although their production data are not available. The construction of a beet sugar factory at Charsadda is almost completed and a trial run was to be made in August of this year. A new distillery, supplied by A.P.V. Co. Ltd., Usines de Melle S.A. and Acme Coppersmithing and Machine Co., was completed in November 1958 and is producing absolute alcohol from molasses at the rate of 2,700,000 litres a year. This alcohol is to be used as power alcohol by mixing with petrol for use in cars.

Stock Exchange Quotations

CLOSING MIDDLE

London Stocks (*at 17th September*, 1959)	
Anglo-Ceylon (5s)	16/6
Antigua Sugar Factory (£1)	15/6
Booker Bros. (10s)	25/1½
British Sugar Corp. Ltd. (£1)	20/3
Caroni Ord. (2s)	4/6
Caroni 6% Cum. Pref. (£1)	17/6
Distillers Co. Ltd. (6s. 8d. units)	28/6
Gledhow Chaka's Kraal £1)	73/9
Hulett & Sons (£1)	87/–
Jamaica Sugar Estates Ltd. (5s units)	8/–
Leach's Argentine (10s units)	13/–
Reynolds Bros. (£1)	62/6
St. Kitts (London) Ltd. (£1)	63/–
Ste. Madeleine (Ord.) (£1)	30/6
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United Fruit Co.	25½
West Indies Sugar Corp. ($1)	41

Dutch Import Duty on Raw Sugar.[4]—An import duty on foreign raw sugar of 20 guilders per 100 kilos has been introduced. The tax paid on sugar used in products which are exported is to be refunded.

* * *

Cuban Sugar Production.[5]—With the completion of operations at the Tanamo mill, the 1959 sugar crop in Cuba has come to an end. Against a decreed production of 5·8 million Spanish tons the actual outturn has been put finally at 5,790,391 tons. Production last year amounted to 5,608,065 tons.

* * *

Cuban High-Test Molasses Authorization.[6]—The Cuban Sugar Stabilization Institute on 7th May authorised the production by one of the Oriente mills of about 2·2 million gallons of special high-test molasses which will be supplied to two U.S. firms for making antibiotics, citric acid and other pharmaceutical products.

* * *

Turkey Sugar Surplus.[7]—It is reported that Turkey has 30,000 tons of white sugar available for export, although it was announced earlier this year that increased domestic consumption would prevent Turkey from exporting sugar for a number of years. Turkey is not a member of the International Sugar Agreement.

* * *

Flacq United Estates Ltd., 1958 Report.—Although the 1958 crop had to a certain extent been handicapped by the two cyclones which visited Mauritius in March and April, the total tonnage of cane crushed amounted to 463,401 tons (447,286 tons in 1957) out of which 265,144 tons came from the Company's own lands and 198,257 tons were delivered by planters. The average extraction was 12·22 (12·59 in 1957) and the yield of sugar per acre was 3·947 tons (4.2 tons in 1957). The crushing period lasted 121 days and the average crushing rate was 191·5 t.c.h. (186·4 t.c.h. in 1957). The outturn of sugar was 56,916 tons, of which 219 tons were received from Deep River Beau Champ Ltd. for Flacq estate cane crushed at Beau Champ factory. In addition a claim for 1064 tons of sugar has been made to the Cyclone and Drought Insurance Board. A new concrete village has been built at Bonne Mère to replace that destroyed by fire in 1958. Reconditioning and improvement of Sans Souci village is continuing, and a modern shop and two social centres should be erected in Happy Village by end-1958. By the end of 1959 the company will have spent 5 million rupees on its housing programme since its formation in 1948. A new 4000 kW Brush turbo-alternator is to be commissioned at the beginning of the 1959 crop and will permit the supply of further power to the Central Electricity Board. It had been decided to bring the factory capacity to 240–250 t.c.h. and steps are being taken to that end. New machinery added during the current intercrop includes a fourth 30-ton high pressure boiler, a turbine-driven 7th mill, the turbo-alternator above, two Ruth's steam accumulators, a 13,200 sq. ft. pre-evaporator; two juice heaters, a 40-ton vacuum pan, four Fletcher-Blanchard crystallizers, two Broadbent centrifugals, about 500 ft of bagasse carriers, and several juice and massecuite pumps. The factory's high and low pressure steam piping has been completely re-designed and re-positioned. A new modern workshop with foundry has been built. The Company has been actively replacing the former cane varieties (mostly M 134/32) by new and improved varieties. Experiments, so far successful, are also being made with overhead irrigation. The construction of a second 500,000 cu. ft. reservoir for storage of the Company's water has been completed and the building of a third of the same capacity is contemplated.

---

[1] *Sugar News* (Hawaii), 1959, **9**, (6), 1.
[2] *I.S.J.*, 1958, **60**, 183.
[3] *Zeitsch. Zuckerind.*, 1959, **84**, 417.
[4] GATT *International Trade News Bull.*, 1959, 189.
[5] *Willett & Gray*, 1959, **83**, 354.
[6] *Foreign Crops & Markets*, 25th May 1959.
[7] F. O. LICHT, *International Sugar Report*, 1959, **91**, (7), 68.

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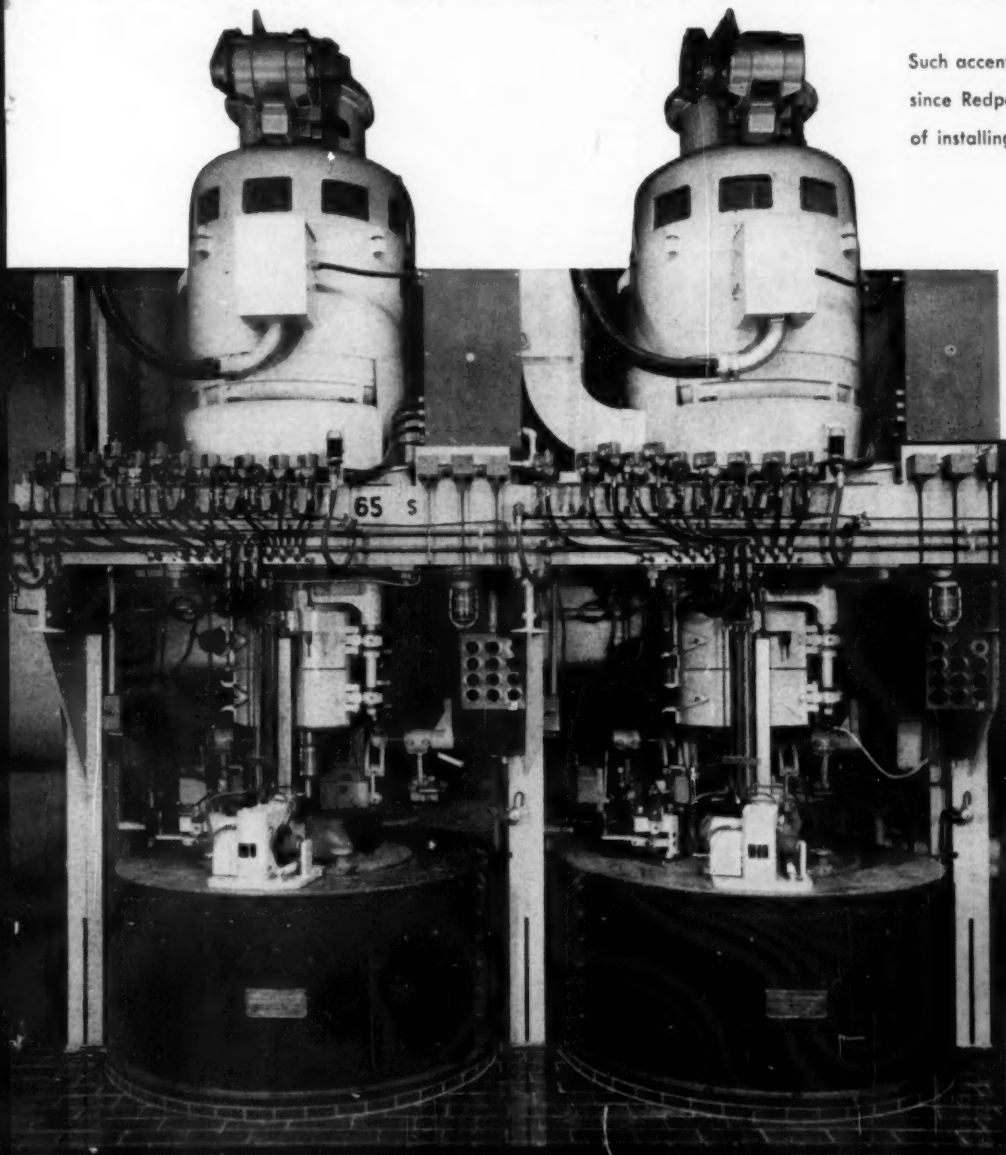

The two automatic recycling centrifugals shown here are part of an installation of 14 Roberts Centrifugals in service at the Redpath Toronto Refinery of Canada and Dominion Sugar Co., Ltd.

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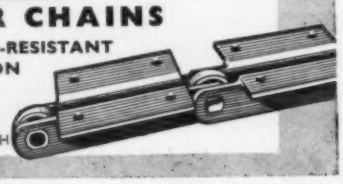

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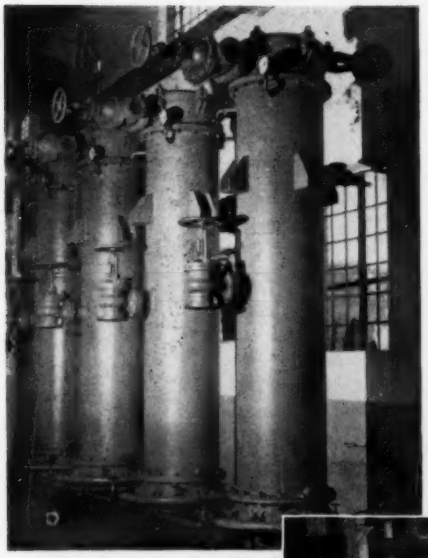

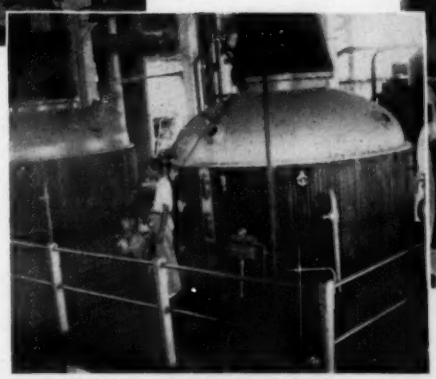

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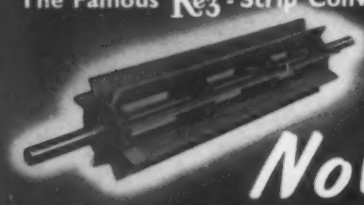

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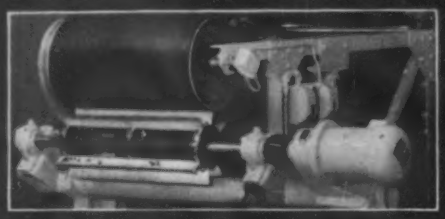

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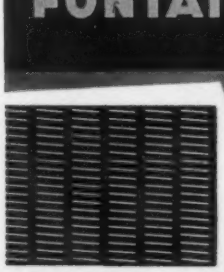

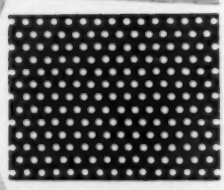

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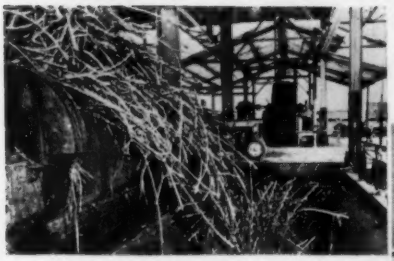

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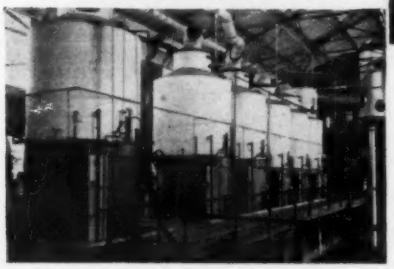

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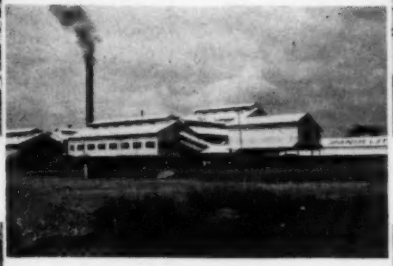

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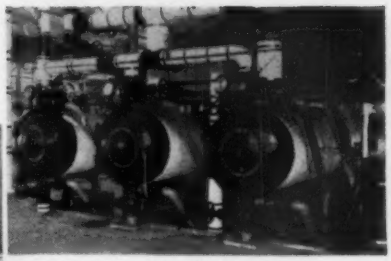

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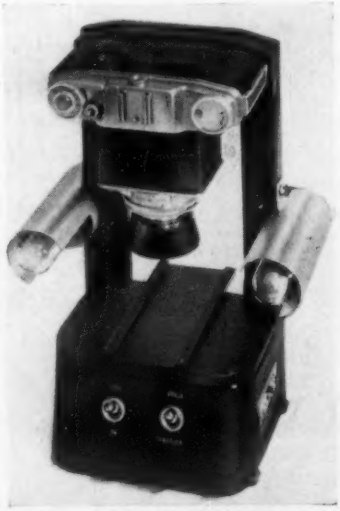

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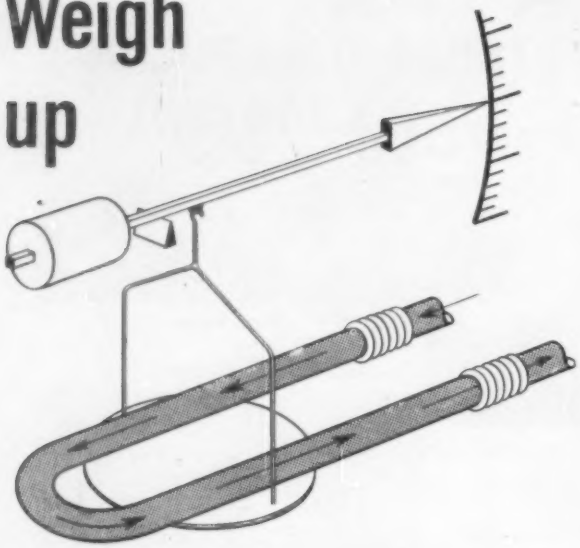

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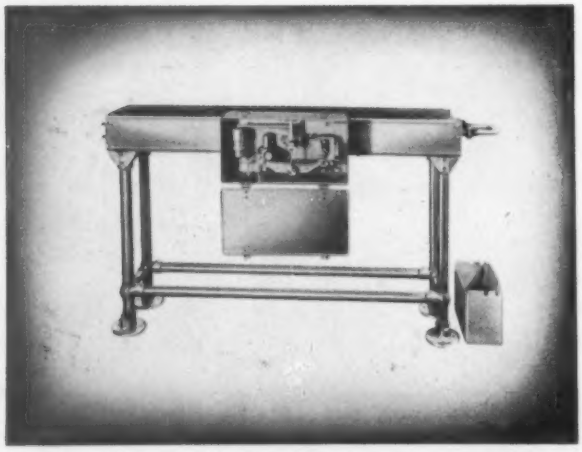

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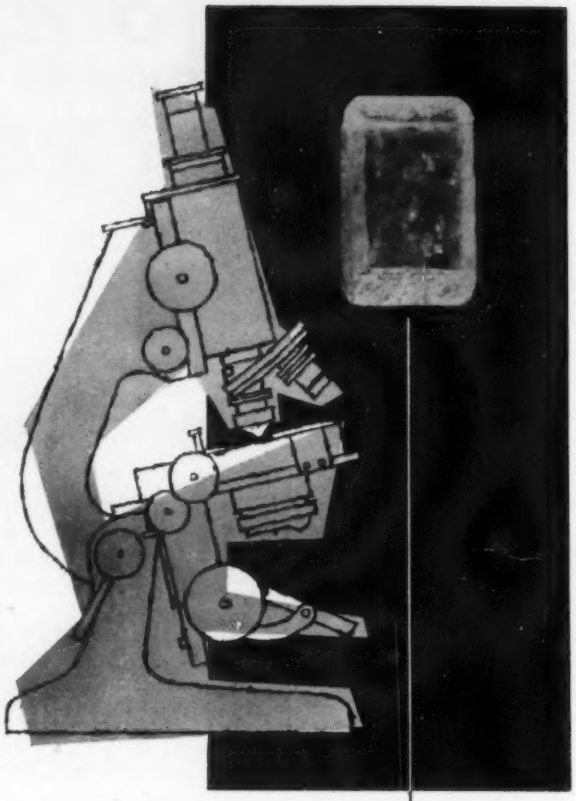

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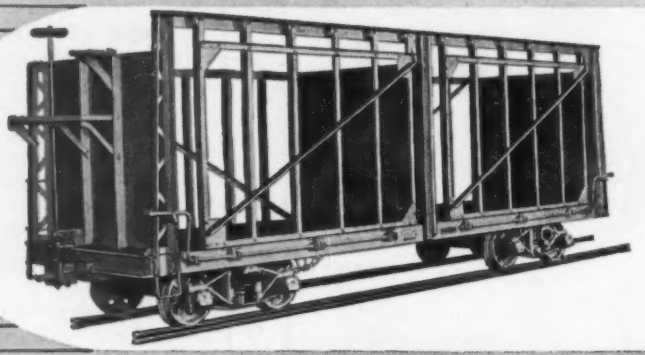

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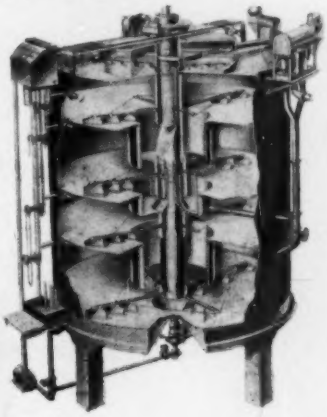
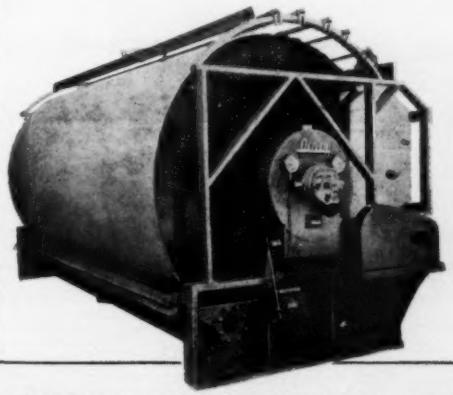
The RapiDorr Clarifier is a *high capacity* unit that allows faster processing of hot thin juice with consequent reduction in losses. It handles equivalent tonnages and achieves comparable results with *30% less volume*. The RapiDorr Clarifier design can be applied to existing units and working capacity can be *greatly increased* at moderate cost. Bulletin No. 4092 gives the complete story.

Write for your copy.



Oliver-Campbell Cane Mud Filters

Designed for long life and economical operation, Oliver-Campbell Filters incorporate the latest filtration developments resulting in efficient, low cost cane mud washing. Operating advantages include — less inversion of sucrose and less re-solution of impurities, higher purity filtrate, cleaner, more compact filtration station and accurate accounting of sucrose recovery. Hundreds of Oliver-Campbell Filters are used throughout the world. Bulletin No. 4093 gives the complete story. Write for your copy.



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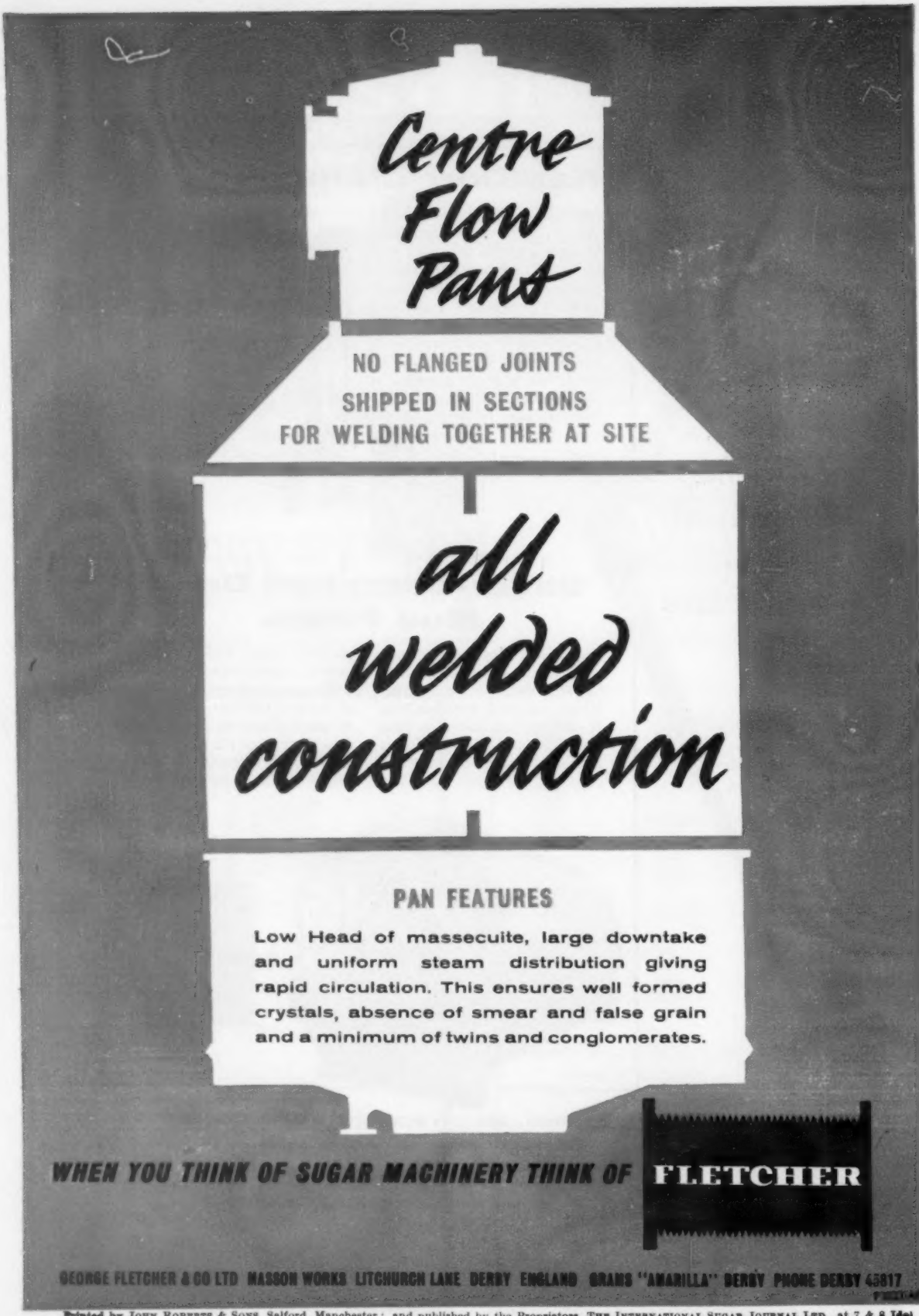
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Low Head of massecuite, large downtake and uniform steam distribution giving rapid circulation. This ensures well formed crystals, absence of smear and false grain and a minimum of twins and conglomerates.
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